

Forecast**PRO**[®]

forecastpro.com

BUSINESS FORECAST SYSTEMS

The comprehensive solution
for all of your
business
forecasting
needs

Forecast Pro TRAC User's Guide

Eric A. Stellwagen
Business Forecast Systems, Inc.

Copyright © 1990-2012 Business Forecast Systems, Inc.

All Rights Reserved Worldwide. No part of this document may be reproduced
without express written permission of Business Forecast Systems, Inc.

Software Version 2.2
Manual Last Revised: February 8, 2012

Business Forecast Systems, Inc.
68 Leonard Street, Belmont, MA 02478 USA
Phone: (617) 484-5050 ♦ Fax: (617) 484-9219
Email: info@forecastpro.com ♦ Web: www.forecastpro.com

Copyright Notice

Copyright © 1990 - 2012 by Business Forecast Systems, Inc. All Rights Reserved Worldwide. No part of this manual may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any human or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without express written permission of Business Forecast Systems, Inc., 68 Leonard Street, Belmont, MA 02478 USA.

Disclaimer

Business Forecast Systems, Inc. makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for any particular purpose. Further, Business Forecast Systems, Inc. reserves the right to revise this publication and to make changes from time to time in the contents hereof without obligation of Business Forecast Systems, Inc. to notify any person or organization of such revision or change.

Trademarks

Forecast Pro is a registered trademark of Business Forecast Systems, Inc.

Other product names mentioned in this manual are trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Contents

GETTING STARTED

Before You Begin	3
Forecasters and Collaborators.....	3
How to Use This Manual	4
Statistical Reference Manual (PDF only)	6
Checking Your Forecast Pro TRAC Package.....	7
What You Need to Run Forecast Pro TRAC	7
Registering Your Forecast Pro TRAC Package.....	8
Future Development of Forecast Pro TRAC	8
 Installing Forecast Pro TRAC	 9
Automatic Installation.....	9
Manually Installing the 32-bit or 64-bit Version.....	10
 A Quick Overview of Forecasting	 11
What is Statistical Forecasting?	11
Forecasting Methodologies.....	13
Some Forecasting Tips.....	15

TUTORIAL: General Operations

The Basics	19
The Main Menu	19
An Overview	21
Setting the Defaults	21
Defining the Script	23
Reading in the Data	24
Generating the Forecasts	26
Viewing the Forecast Report	27
Customizing the Graph View	29
Overriding the Forecasts	32
Working With a Hot List	33
Saving the Forecasts	36
Saving the Project	39
 Working with Conversions and Alternative Hierarchies.....	41
The Default State	41
Locked and Unlocked Modes	42
Working with Alternative Units of Measure	43
Changing the Hierarchy	44
Working with Override Sets	45
 Updating a Forecast Project	49
Defining the Forecasting Process	49
Step One: Updating Your Data Files	50
Step Two: Opening Your Forecast Project	51
Step Three: Saving Your Work	52
Working with Override Sets	52
 Collaborating With Colleagues.....	57
Stand-alone Projects vs. Team Archives	57
Sharing a Stand-alone Project	58
Working with Team Archives	61
 Pareto Analysis and Report Filtering	65
Defining Pareto Classifications Within Forecast Pro	65
Sorting and Filtering the Pareto Output	67
Defining Pareto Classifications via a Custom Filter	69

Tracking Forecast Accuracy	71
Reading the Tracking Report.....	71
Customizing the Tracking Report.....	74
Exception Reporting	75
Monitoring Current Forecasts.....	75
Monitoring Archived Forecasts	78
Operating From the Command Line	81
Command-Line Operation	81

TUTORIAL: Forecasting Operations

Using Forecast Modifiers	87
Specifying Forecast Modifiers for Individual Items.....	87
Specifying Forecast Modifiers for Multiple Items	89
Specifying Custom Forecast Modifiers	90
Building Event Models	91
Modeling Promotions	92
Modeling Weekly Data	95
Adjustment for Outliers	99
More Adjustments for Promotions.....	100
Building Multiple-Level Models.....	101
Bottom-up and Top-down Forecasting	101
Defining Groups Using Attribute Fields.....	104
Combining Multiple Level and Event Adjustment Models.....	105
Short-Lived Products	106
New Product Forecasting	109
Working With No Data.....	109
Forecasting by Analogy	111
Using the Bass Model	114
Using Weighting Transformations	117
Adjusting for 4 vs. 5 Week Periods	117
Other Uses for Weighting Transformations.....	120

Detecting and Correcting Outliers	121
How Outlier Detection and Correction Works	122
Reviewing the Outliers	123
Correcting the Outliers.....	124
 Out-of-sample Testing	 127
Setting Up the Script for Evaluation.....	128
Examining the Analytic Output	129
Comparing an Alternative Model	130

REFERENCE

Setting Up Your Data	135
Overview	135
Selecting a Data Format.....	139
Spreadsheet Formats	140
Text (MLT) Formats	145
Using ODBC	147
Using Attribute Fields to Define a Hierarchy	150
Defining the Secondary File	152
 Saving Your Work	 159
Forecast Projects	160
Numeric Output Files.....	163
Formatted Forecast Reports	163
Tracking Reports.....	164
Item Reports.....	165
Override Reports.....	165
Exception Reports.....	166
Outlier Reports.....	166
 Working with Scripts and Hierarchies	 167
Defining the Script.....	167
Defining the Hierarchy	168
Reconciling the Hierarchy	170

Using Forecast Modifiers	175
Model Specification Modifiers	175
Event Model Modifiers	180
The Weighting Transformation Modifier	181
Outlier Detection/Correction Modifiers.....	182
Reconciliation Modifiers	183
Miscellaneous Custom Modifiers	184
 Command Reference	 185
Operations Overview	185
The Forecast Pro TRAC Interface	186
The Forecast Report View	193
The Graph View.....	195
The Override Forecasts View	198
The Tracking Report and Tracking Report Graph Views.....	200
The Item Report View	204
The Exception Report View	204
The Override Report View	211
The Outlier Report View	212
The Numeric Output View.....	212
Menu Items and Dialog Boxes.....	216
Working with Team Archives.....	235
Using a Time Fence	236
Command-line Operation.....	238
 Understanding How Forecast Overrides are Allocated	 241
Adjustments Made to a Single Level.....	241
Adjustments Made to More Than One Level	243
Examples Where Overrides Cannot be Allocated	245
Summation	247
 Appendixes.....	 249
Speeding Up the Program	249
End-User License Agreement	253
Suggested Reading.....	256
 Index.....	 259



1

GETTING STARTED

Chapter 1

Before You Begin

Forecasters and Collaborators

Forecast Pro TRAC is available in two different types of licenses—Forecaster licenses and Collaborator licenses. The type of license you install will dictate the functionality you can access. A Forecaster has access to all of the functionality described in this manual. A Collaborator can view and manipulate a forecast project created by a Forecaster (including viewing graphs and reports, adding overrides and comments, saving output, etc.) but cannot generate new statistical forecasts.

Operationally, the two installations are very similar, however, a Collaborator does not have access to any of the functionality relating to reading historical data and generating statistical forecasts. Thus, there are sections of this manual which will not be relevant to Collaborators.

How to Use This Manual

This manual is divided into four parts.

Part 1 Getting Started

Chapter 1 describes the Forecast Pro TRAC system requirements and product support policy.

Chapter 2 describes the installation procedure.

Chapter 3 provides an overview of forecasting.

Part 2 Tutorial: General Operations

Lesson 1 walks you through a sample forecasting session using automatic model selection.

Lesson 2 teaches you how to work with conversions and alternative hierarchies.

Lesson 3 teaches you how to update your forecast project as new data become available.

Lesson 4 teaches you how to collaborate with colleagues to establish the final forecast. It covers both sharing stand-alone forecast projects and using team archive files to break large forecasting projects into smaller pieces that can be worked on separately and then reassembled into consolidated forecasts.

Lesson 5 teaches you how to use Pareto analysis to assign ABC classifications to your forecast items and how to sort and filter reports.

Lesson 6 teaches you how to archive your forecasts and use waterfall reports to track your forecast accuracy.

Lesson 7 teaches you how to use exception reports to identify poor forecasts and other potential problems in an efficient manner.

Lesson 8 teaches you how to operate the program from the command line.

4 Before You Begin

Part 3 Tutorial: Forecasting Operations

Lesson 9 teaches you how to use forecast modifiers to dictate model selection.

Lesson 10 teaches you how to build event models to capture promotional effects.

Lesson 11 teaches you how to set up and forecast a multiple-level script.

Lesson 12 teaches you how to forecast new products prior to historic data being available and also teaches you how to use the forecast by analogy and Bass models.

Lesson 13 teaches you how to use weights to adjust for trading day impacts or to forecast new products based on similar products.

Lesson 14 teaches you how to use Forecast Pro TRAC's outlier detection and correction functionality.

Lesson 15 teaches you how to assess forecasting performance using a holdout sample approach.

All of the lessons use sample data provided with the software.

Part 4 Reference

Chapter 1 explains how to select the appropriate data format and how to set up your database.

Chapter 2 describes the various reports and output files that can be saved.

Chapter 3 describes how to set up a Forecast Pro TRAC script and also discusses the strategies that Forecast Pro TRAC uses to produce consistent forecasts for hierarchical data.

Chapter 4 describes all available forecast modifiers and their functions.

Chapter 5 is a complete reference to Forecast Pro TRAC menus, options and commands.

Chapter 6 describes how Forecast Pro TRAC reconciles forecast adjustments between different levels of the forecasting hierarchy.

The Appendixes describe how to speed up processing and provide other supplementary information.

Many users won't want to work their way through each and every part of this manual. However, we urge you to go through at least Chapters 1-3 of Getting Started, Lesson 1, 2 & 3 of the Tutorial and as many other lessons as you want. This will give you a good overview of Forecast Pro TRAC operations and capabilities.

When you are ready to set up your own data, please consult Chapter 1 of Part 4 Reference.

Statistical Reference Manual (PDF only)

The *Forecast Pro Statistical Reference Manual* describes the statistical techniques, statistics, and strategies that are implemented in Forecast Pro. It is not necessary that you fully understand, or even read, this manual in order to produce accurate forecasts with the product.

The manual is provided in electronic format (pdf). When Forecast Pro TRAC is installed, the file is copied into the program directory. You can access the file directly or via the Help menu in Forecast Pro TRAC.

Chapter 1 is a detailed statistical reference. It explains the theory behind Forecast Pro TRAC's statistical models, diagnostics and methodology.

Chapter 2 is a discussion of some of the general considerations that apply to automatic batch forecasting.

Checking Your Forecast Pro TRAC Package

Your Forecast Pro TRAC package should contain the following items:

This User's Manual. This book walks you through the installation and use of Forecast Pro TRAC.

One installation CD.

A warranty registration card.

A maintenance and support contract.

If your package is missing any of the above items please contact Business Forecast Systems, Inc.

What You Need to Run Forecast Pro TRAC

A computer running a Windows operating system.

A minimum of 512 MB of random access memory (RAM). Additional memory will greatly enhance program performance. We recommend 2 Gigs if you are running a 32-bit operating system and as much RAM as your budget can afford if you are running a 64-bit operating system.

A hard disk drive with 30 MB of free space.

Registering Your Forecast Pro TRAC Package

Please take a moment NOW to fill out and mail the Registration Card you received with Forecast Pro TRAC or visit www.forecastpro.com and register on-line. Registering your software entitles you to the following benefits:

- Free maintenance and support service for one year. This service provides program updates and unlimited technical support for the first year you license the program. After the first year, this service is available on a subscription basis. Technical support is provided via the telephone (during regular business hours Eastern Standard Time), via email, mail and fax.
- Automatic notification of upgrades, revisions and new products.
- Special pricing on upgrades, revisions and new products.

Future Development of Forecast Pro TRAC

BFS has made many changes to Forecast Pro TRAC to accommodate special needs and circumstances in the corporate environment. BFS will continue to improve Forecast Pro TRAC in the years to come. If you encounter problems or have any suggestions for improvements or additional features please contact the BFS product development staff.

Chapter 2

Installing Forecast Pro TRAC

Automatic Installation

Forecast Pro TRAC can be installed as a native 32-bit or native 64-bit application. The installation program, FPSetup.exe, will automatically detect the operating system you are running and install the appropriate version. Running FPSetup is the recommended way to install Forecast Pro TRAC.

If you would prefer to use an MSI to directly install the 64-bit version or if you are running a 64-bit operating system but would like to install the 32-bit version, you will find instructions for doing so in the next section.

To install Forecast Pro TRAC on your hard disk using FPSetup, perform the following steps.

Run the FPSetup program as an Administrator. The program is located in the root directory of the CD (e.g., D:\).

Follow the directions that appear on the screen. The installation program will prompt you for your serial number and CD-Key. These numbers are printed on the CD label and sleeve. If you are installing from a download, the

numbers should have been included with the email that provided the download link.

Setup will then create the program directory, data directories, copy the appropriate files, create a launch icon on the program menu and place a launch icon on the desktop. It will also install SQLite drivers. The driver installation launches a separate installation dialog which includes a separate click-through license agreement.

If you have any difficulty installing Forecast Pro TRAC please do not hesitate to contact BFS technical support (phone: 617 484-5050, email: support@forecastpro.com).

If you wish to remove Forecast Pro TRAC from your computer, use the Add/Remove Programs utility in the Windows Control Panel.

Manually Installing the 32-bit or 64-bit Version

As we discussed in the previous section, the FPSetup program automatically detects whether you are running a 32-bit or 64-bit operating system and installs the matching version.

Alternatively you can run either the 32-bit or 64 bit setup program directly.

The 64-bit installation uses an MSI file called ForecastProTRAC.msi which is located in the directory d:\x64\en-us\.

The 32-bit installation uses an InstallShield installation program called Setup.exe which is located in the directory d:\Win32\.

Chapter 3

A Quick Overview of Forecasting

What is Statistical Forecasting?

Everybody forecasts, whether they know it or not. Businesses have to forecast future events in order to plan production, schedule their work force, or prepare even the simplest business plan.

Most business forecasting is still judgmental and intuitive. Sometimes this is appropriate. People must integrate information from a large variety of sources—qualitative and quantitative—and this is probably best done by using the extraordinary pattern recognition capabilities of the human brain. Unfortunately, many companies also use judgmental forecasting where they should not.

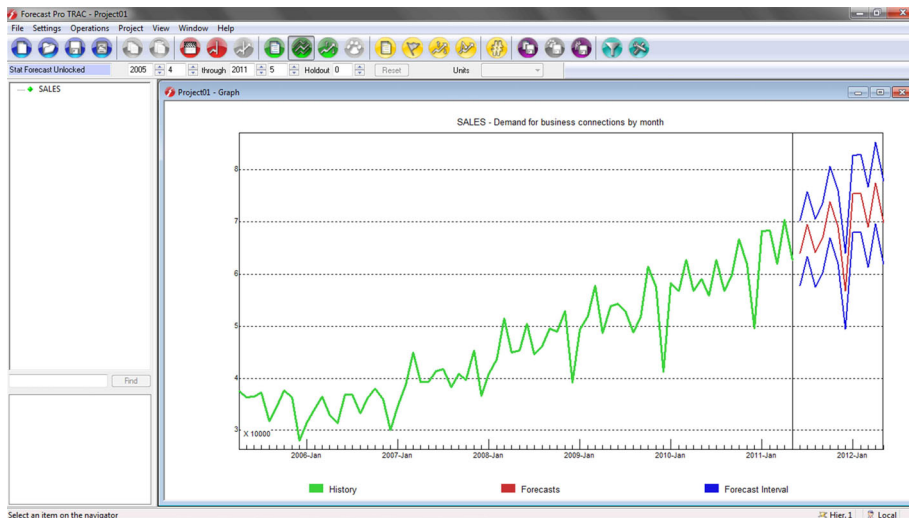
Not everyone understands the concept of forecasting. It tends to get mixed up with goal setting. If a company asks its salespeople to forecast sales for their territories, these “forecasts” often become the yardsticks by which they are judged.

The main advantage of statistical forecasting is that it separates the process of forecasting from that of goal setting, and makes it systematic and objective.

Objective, quantitative forecasting can help almost any business substantially. There is, in other words, value added for business.

The future is uncertain, and this uncertainty must be represented quantitatively. Statistical forecasting represents uncertainty as a *probability distribution*. Two kinds of information are needed to describe the distribution: the *point forecasts* and the *confidence limits*.

A point forecast is the mean value of the distribution of future values, and can be thought of as a best estimate of the future value. Its upper and lower confidence limits describe the spread of the distribution above and below the point forecast. Forecast Pro TRAC depicts this information graphically as well as numerically.



The upper confidence limit is often calibrated to the ninety-fifth percentile. This means that the actual value should fall at or below the upper confidence limit about 95% of the time. You can set the percentiles of both the upper and lower confidence limits.

Let's illustrate this idea with an example. Suppose you were in charge of forecasting widget sales for your company. If you wanted to determine expected revenues for next month, you would be most interested in the point forecast, since it is the mean value of the distribution. The point forecast gives you the minimum expected forecast error.

12 A Quick Overview of Forecasting

On the other hand, suppose you wanted to know how many widgets to produce. If you overproduce, warehousing costs will be excessive. But if you underproduce, you will probably lose sales. Since the cost of lost sales is usually greater than the cost of overstocking, you will be most interested in the upper confidence limit. The upper confidence limit tells you how many widgets to produce to limit the chance of “stocking out” to less than 5%.

Forecasting Methodologies

A wide variety of statistical forecasting techniques are available, ranging from very simple to very sophisticated. All of them try to capture the statistical distribution that we have just discussed.

Forecast Pro TRAC offers the five methodologies that are most appropriate for automated business forecasting: simple moving averages, discrete data models (Poisson or negative binomial), Croston’s intermittent data model, exponential smoothing and Box-Jenkins. All of these models are *univariate* techniques. They forecast the future entirely from statistical patterns in the past.

Thus you must have historic records, preferably for several years, of the variable you want to forecast.

Forecast accuracy depends upon the degree to which statistical data patterns exist, and their constancy over time. The more regular the series, the more accurate the forecasts.

The *simple moving average* is widely used in business, mostly because it is so easy to implement. However, it is really only appropriate for very short or very irregular data sets, where statistical features like trend and seasonality cannot be meaningfully determined.

Discrete data models are used for data consisting of small whole numbers. These models are characteristically used to model a slow-moving item for which most orders are for only one piece at a time. Forecasts are nontrended and nonseasonal.

Croston’s intermittent demand model is not a widely known or used technique but, in certain circumstances, it is extremely useful. It is usually used to model

data in which a significant number of periods have zero demand but the non-zero orders may be substantial. This is characteristic of a slow-moving item which is ordered to restock a downstream inventory. Forecasts are nontrended and nonseasonal.

Exponential smoothing models are widely applicable. They are also widely used, because of their simplicity, accuracy, and ease of use. Their robustness makes them ideal even when the data are short and/or volatile. Exponential smoothing works by identifying and extracting trend and seasonality, and extrapolating them forward.

Box-Jenkins is a more elaborate statistical method than exponential smoothing. Box-Jenkins works by capturing the historic correlations of the data, and extrapolating them forward. It often outperforms exponential smoothing in cases when the data are fairly long and nonvolatile. However, it doesn't usually perform as well when the data are statistically messy.

You can use Forecast Pro TRAC's *expert selection* to automatically choose the appropriate forecasting technique for each item forecasted. Alternatively, you can dictate that a specific method be used. If you are already familiar with statistical forecasting, you can use Forecast Pro TRAC to customize your models. It provides extensive diagnostics and statistical tests to help you make informed decisions.

Forecast Pro TRAC includes three additional forecasting techniques that are not considered in expert selection—event models, forecasting by analogy and the Bass diffusion model.

Event Models are extensions of exponential smoothing models that allow you to capture responses promotions, business interruption and other aperiodic events. These models allow you to assign each period into logical categories and incorporate an adjustment for each category. For example if you establish a category for promoted months then your model would include an adjustment for promoted months. If you ran three different types of promotions you could establish three categories and have a different adjustment for each type of promotion.

Forecasting by Analogy is a new product forecasting technique that allows you to create a forecast that “looks like” a different product's demand pattern or a launch profile that you create.

14 A Quick Overview of Forecasting

Bass Diffusion Model is a new product forecasting technique designed to forecast the spread of a new technology, product or method based on the adoption rates of two types of users—innovators who are driven by their desire to try new products and imitators who are primarily influenced by the behavior of their peers.

If you are new to forecasting and these techniques seem a little intimidating, don't worry. We designed Forecast Pro TRAC to guide you completely through the forecasting process. Just follow the program's advice all the way to accurate forecasts.

Some Forecasting Tips

Forecast Pro TRAC uses the history of your data to forecast the future. Thus it is extremely important that your data be as accurate and as complete as possible. Keep in mind the rule, “Garbage in, garbage out!”

You will also want to give some thought to what data you should forecast. If you want to forecast demand for your product you should probably input and forecast incoming orders rather than shipments, which are subject to production delays, warehousing effects, labor scheduling, etc. Many corporations are making large investments to obtain data as close to true demand as possible.

The more data you can supply the program the better. Statistical forecasts generated from very short series are simplistic and usually not very accurate. Although collecting additional data may require some effort, it is usually worth it.

If your data are seasonal, it is particularly important that you have adequate data length. The automatic model selection algorithms in Forecast Pro TRAC will not consider seasonal models unless you have at least two years worth of data. This is because you need at least two samples for each month or quarter to distinguish seasonality from one-time irregular patterns. Ideally you should use three or more years of data to build a seasonal model.

Finally, remember that forecasts are never perfect. Forecast Pro TRAC bases its forecasts solely on the past history of your data. If you know something that Forecast Pro TRAC did not, then you may want to adjust the forecasts

judgmentally. For instance, you may know of future events like a large upcoming sale or the introduction of a new product. You can use the quantitative forecasts as a starting point, and apply your own insight and knowledge of future events to improve them.

2

TUTORIAL: General Operations

Lesson 1

The Basics

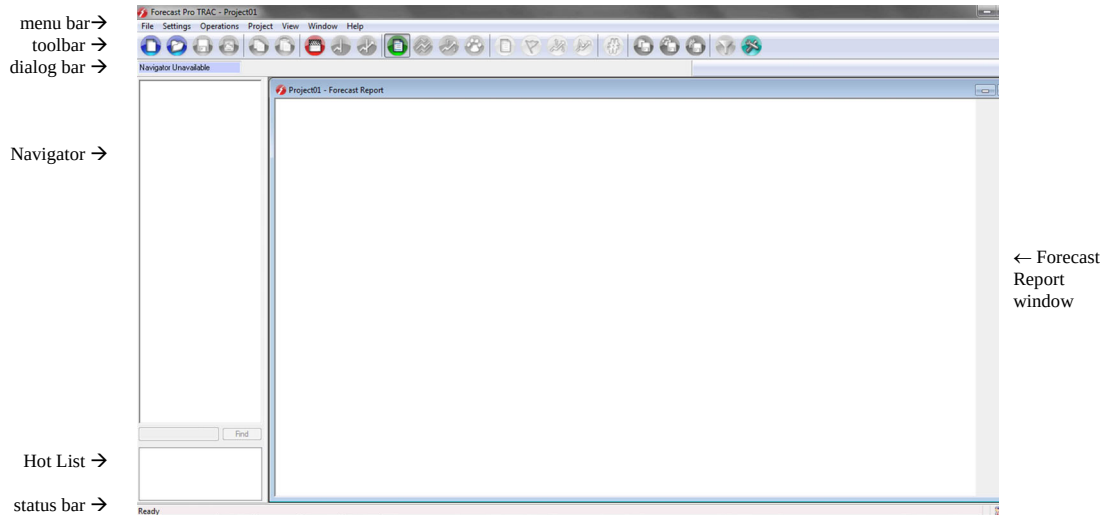
Before you can use Forecast Pro TRAC effectively, you must learn some basic concepts. This tutorial will guide you through these fundamentals. The tutorial is divided into staged lessons. You should complete them all to get a sound introduction to Forecast Pro TRAC.

This first lesson provides an overview of Forecast Pro TRAC and guides you through a sample forecasting session.

Before you can use Forecast Pro TRAC, you must install it. If you have not already done so, follow the installation instructions discussed in Chapter 2.

The Main Menu

To start Forecast Pro TRAC click the Start button, select All Programs and click the Forecast Pro TRAC icon. After the program is loaded, you will see a display like the one below.



The main window, entitled *Forecast Pro TRAC* consists of a menu bar, a toolbar, a dialog bar, a Navigator (currently unavailable), a Hot List area, a Forecast Report window and a status bar.

The menu bar provides access to all procedures. The most commonly used procedures can also be accessed instantly via the icons on the toolbar. The dialog bar is currently blank. After data have been read in, the dialog bar will include the span of the data, the specified holdout sample and the currently displayed units. The Navigator and Hot List are currently unavailable. After data have been read in, the Navigator and Hot List can be used to select individual items that you wish to view.

The Forecast Report window is used to display the forecasting model, within-sample statistics, historic data and forecasts. The Forecast Report window is one of four context-sensitive views. A graph view will become available after data has been read in. An override view will become available after forecasts have been generated. A forecast tracking view will become available if there are archived forecasts. Active views display information for the item currently selected on the Navigator. When more than one view is active, the program will tile them. The views are toggled on or off using the green icons or the View menu.

Five additional noncontext-sensitive views are also available—the item report view, the exception report view, the override report view, the outlier report

view and the numeric output view. These views display information for all items forecasted and are toggled on or off using the yellow icons or the View menu.

An Overview

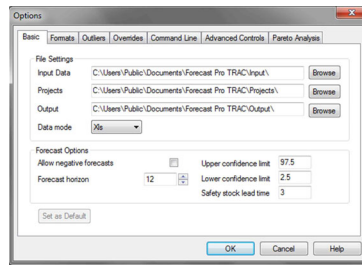
Running Forecast Pro TRAC consists of executing the following five steps:

1. Prepare the database. This is performed outside of the program and entails selecting the type of data format to use and preparing the files. Creating your data files is discussed in the first chapter of the Reference section. For this lesson you will use sample data files provided with the package.
2. Specify the data format and default options. This is accomplished by selecting the appropriate entries from the Options dialog box. All options set by the user will be used for the current forecast project. You can also save your selections as the default for future projects.
3. Create the script. The script is a list of the data files to be forecasted and any special instructions. It is created using the Define Script dialog box.
4. Select **Operations>Read Data**. Forecast Pro TRAC will then read the data from disk into RAM and display the starting and ending dates for the forecast run on the dialog bar.
5. Select **Operations>Forecast**. The software will then execute the current script to prepare the forecasts. Once the forecasts have been created you may view them graphically, adjust them and save them to disk.

The remainder of this lesson will guide you through steps 2-5.

Setting the Defaults

To set the default options click the light blue Options icon () which will open the Options dialog box shown below.



There are seven pages of options on the dialog box accessible via the tabs. The more commonly changed options are found on the Basic tab shown above. The Formats tab is used to set details of the data file interface and control the precision in the on-screen displays. The data file interface defaults have been carefully chosen and should only need to be changed for users using comma-delimited data files, or who do not follow the US conventions for the decimal separator. The Outliers tab allows you to control the settings for outlier detection and correction. This will be covered in Lesson 12. The Overrides tab allows you to customize the override facility. The Command Line tab allows you to control the settings for command-line operation. This will be covered in Lesson 7. The Pareto analysis allows you to dictate how to calculate the ABC classifications. This will be covered in Lesson 5. The Advanced Controls tab is used to set details of the optimization routines and to control how often Forecast Pro TRAC checks for product updates.

Let's take a closer look at the Basic tab. Forecast Pro TRAC reads in the historical data from the Input Data directory. Project files are saved to the Projects directory. Forecast files and reports are written to the Output directory. The Data Mode specifies the format of the historical data. (The forecast output can be saved in any supported format.)

You can set the percentiles for the confidence limits, the lead time for safety stock calculations, the length of the forecasts (forecast horizon) and can tell Forecast Pro TRAC whether or not to allow negative forecasts.

The data for this lesson were copied into your Forecast Pro TRAC input folder when you installed the program (normally Forecast Pro TRAC\Input in your Shared Documents folder). Make sure that the Input Data directory is set correctly and that the other options match those shown above. Click the OK button to accept the defaults and return to the main menu.

If you are using a Forecaster license: proceed to the next section—Defining the Script.

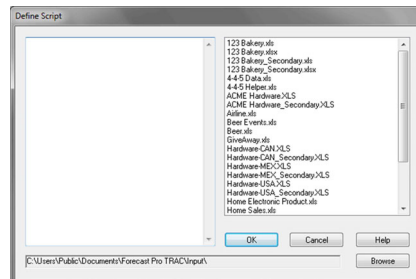
If you are using a Collaborator license: the next three sections (Defining the Script, Reading in the Data and Generating the Forecasts) describe operations that are not supported. The first step in a Collaborator session is to open a forecast project that was created by someone using a Forecaster license. Select **File>Open** and open the forecast project “Lesson 1” then skip the next three sections and proceed to the Viewing the Forecast Report section.

Defining the Script

The next step is to define the script. The script lists the data file(s) you wish to forecast.

In this example we will prepare sales forecasts for 123 Bakery. The data consist of monthly sales of Muffins and Cakes.

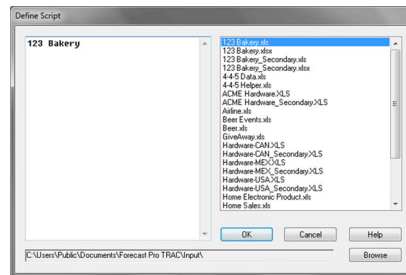
Click the red Script icon () to call up the Define Script dialog box shown below.



You can type the filenames on the script, one to a line, or you can double-click the filename displayed in the list box to insert the filename onto the script. If you are in ODBC mode, the tables and queries in your database replace filenames.

Double-click the filename *123 Bakery* to insert it on the first line of the script. When you list a data file on a line of the script the program will forecast *every series in the data file*, with the exception of *helper variables*, whose names

must begin or end with an underbar. Thus, our first line instructs the program to forecast all series found in *123 Bakery.xls*.



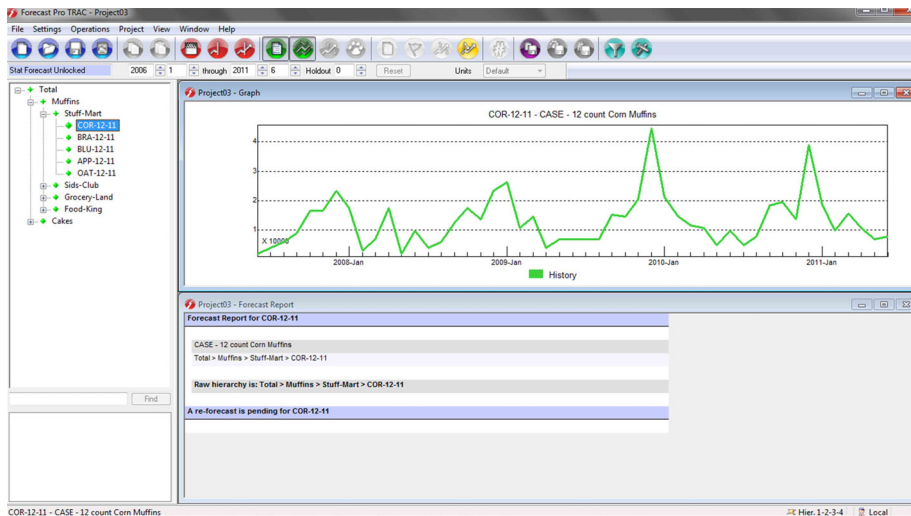
Your script should look like the one above. Accept the script and return to the main menu by clicking the OK button.

Reading in the Data

You may have noticed that the red Read Data icon (📡) which had been grayed out is now activated. Click this icon to read the data into memory. When you read data, any existing data in memory is replaced.

Click the green View Graph icon (📊) to open the graph view and display a graph for *123 Bakery*. Double click *Total* on the Navigator to expand the Navigator's tree. You'll see that the total sales breakdown into Muffins and Cakes. Select *Total>Muffins* on the Navigator to display its graph. If you expand *Total>Muffins* on the Navigator you'll discover a customer-level breakdown and finally an SKU level. Experiment with the Navigator until you are comfortable with its operation. In the next lesson, we'll show you some shortcuts for navigating through complex hierarchies.

After you have explored the data, arrange your display so that it matches the one shown below.

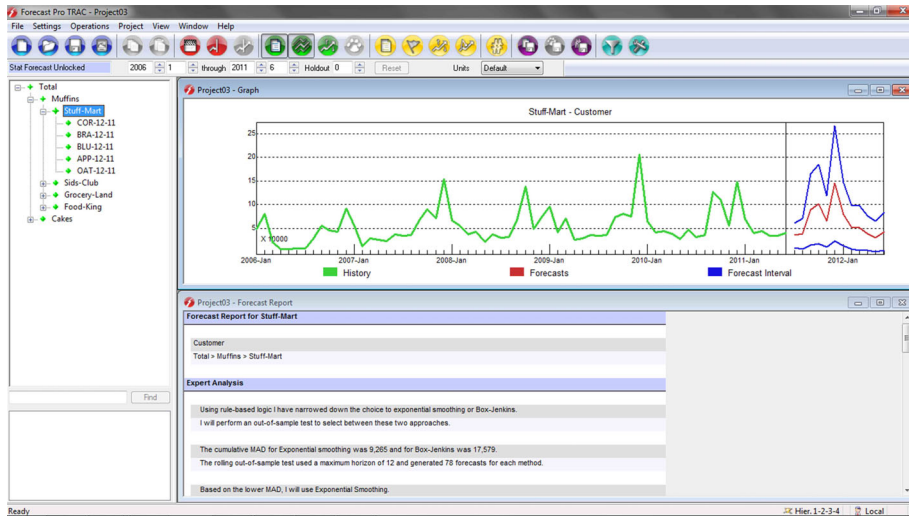


You probably noticed that after the data had been read in, the dialog bar was updated to include the time span of the data and the holdout sample.

The dialog bar displays the earliest and latest period found for the entire script. The ending date is very important. If an individual item has data on the ending date, the item is active and will be forecasted. If an item's history ends prior to the ending date, the item is inactive and will not be forecasted. If you do not adjust the starting or ending dates Forecast Pro TRAC will prepare forecasts using all available data for each active series.

For our current example we will not adjust the time span of the data nor will we define a holdout sample.

Generating the Forecasts



Click the red Forecast icon (📈) to generate the forecasts.

Notice that the Graph view now includes forecast components and the Forecast Report view includes the forecasts and information about how they were generated. Select *Total>Muffins>Stuff-Mart*. Notice that both views are immediately updated to match your current selection.

For this example we used expert selection to create the forecasts. Expert selection can be thought of as an automatic pilot. It analyzes your data statistically to determine the best forecasting technique to use and then proceeds to build the forecasts.

Expert selection begins by running a series of statistical tests on the data. The results of these tests are run through a rule-based logic system. At times this logic system will directly select an appropriate forecasting method. At other times the rule-based logic will narrow down the potential forecasting methods that could be used without producing a clear winner. In these instances, expert selection will use an out-of-sample test to select between the competing models.

The Expert Analysis section of the Forecast Report documents how Forecast Pro TRAC makes its decision. In our example, the rule-based logic was

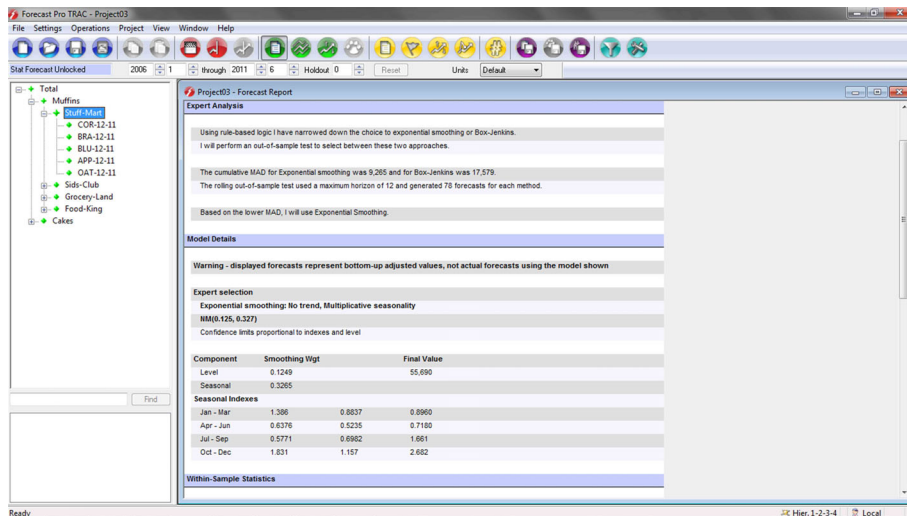
inconclusive, but narrowed down the choices to either an exponential smoothing model or a Box-Jenkins model. An out-of-sample test was then used to choose between these two candidates.

Notice that the expert system acts in much the same way as an expert statistical analyst. It performs a series of statistical tests, interprets the results, performs more tests if necessary and finally makes recommendations based upon the results.

Expert selection works well for most applications. However, Forecast Pro TRAC also allows you to customize your script by adding *modifiers* to the Navigator. A modifier on a particular item gives Forecast Pro TRAC instructions on how to create the forecasts for that item. We will explore the use of modifiers in Lesson 9.

Viewing the Forecast Report

Let's take a closer look at Forecast Report view. Turn off the Graph view by clicking its green icon (📊).



You are currently looking at a standard format Forecast Report. The Forecast Report can be customized and can include up to ten sections. They are:

Expert Analysis documents the logic behind the expert selection's decision. This section will be omitted if a user-specified forecasting model is used.

Model Details documents the specific forecasting model that was used to generate the forecasts.

Within-Sample Statistics provides a set of standardized model statistics that can be used to diagnose the current model as well as to compare and contrast alternative forecasting approaches.

Historic Data (not currently active) lists the history and fitted values along with some aggregated totals and summary statistics.

Forecast Data lists the forecasts and confidence limits along with some aggregated totals and summary statistics.

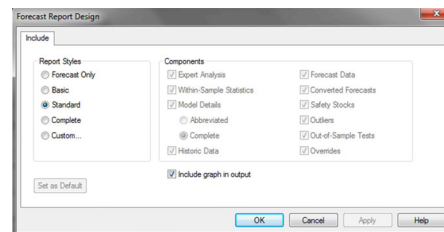
Converted Forecasts (not currently active) lists the forecasts in all the display units that are defined in the secondary file.

Safety stocks (not currently active) lists the safety stocks for different lead times along with the demand during lead time and reorder point.

Out-of-Sample Rolling Evaluation and *Out-of-Sample Static Evaluation* (not currently active) list the out-of-sample statistics that are generated when a holdout analysis is performed.

Outliers (not currently active) lists any detected and/or corrected outliers.

Overrides displays any overrides and/or comments that were entered.



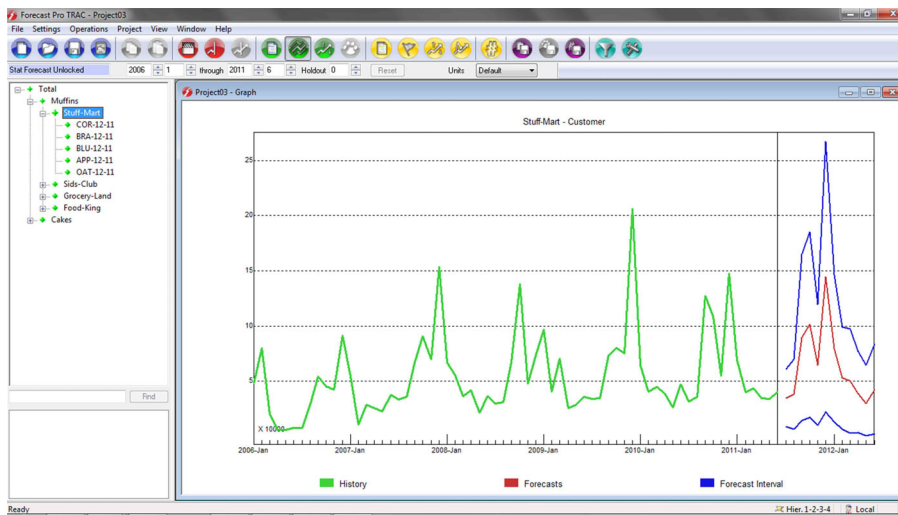
Right click on the Forecast Report view to invoke its context menu. Select **Forecast Report Design**. Notice that this dialog box allows you to select a

standardized report style or create a custom one. Select Forecast Only and click OK.

Notice that this report is much simpler than the standard one. Return to the Forecast Report Design dialog box and experiment with the settings. After you are comfortable with their operation edit the settings to display the Standard report style and click OK.

Customizing the Graph View

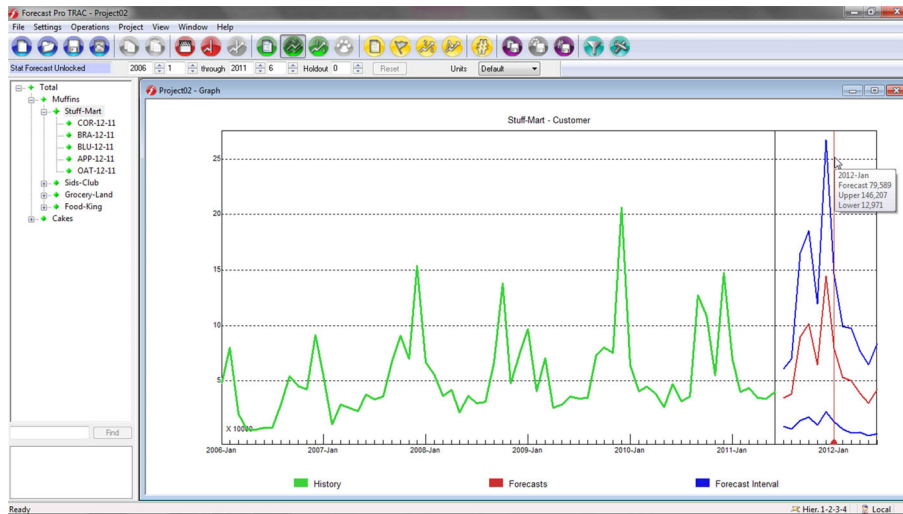
Let's now explore some of the graphical options. Display the Graph view by clicking its green icon (📈). Turn off the Forecast Report view by clicking its green icon (📄). Your display should now match the one shown below.



The green line on the graph represents the demand history for *Total>Muffins>Stuff-Mart*. The red line is the forecast and the blue lines are the confidence limits.

Move the cursor to a point on the graph, hold the mouse very still and click the left mouse button. Notice that the display now includes a vertical red line and a box listing the corresponding date and numeric values of the graph variables.

Click January 2012 (the months are marked along the X-axis). Notice that the red line and box have moved to the new location.

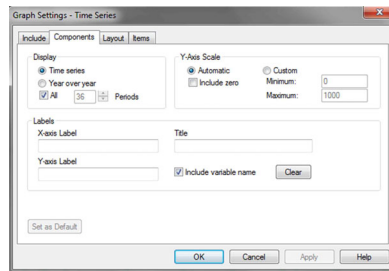


Click the right mouse button to invoke the Graph view's context menu. Select **Data Only**. Notice that selecting Data Only turned off all of the forecast-related components (e.g., the forecasts and confidence limits). Select **Data Only** a second time to turn the forecast-related components back on.

Click the right mouse button to redisplay the context menu. Notice that each individual graph component (History, Corrected History, Forecast, Confidence Limits, Statistical Forecasts, Fitted Values and Historic Intervals) can be toggled on or off.

Select **Graph Settings**. The Graph Settings dialog box allows you to customize your graph in numerous ways.

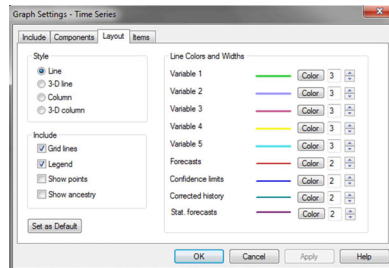
The Include tab allows you to toggle the forecast-related components on and off. Select the Components tab.



Type “123 Bakery, Inc.” into the Title field and click the Apply button. Notice that the title has been added to the graph. Clicking the Apply button implements your current selection without leaving the Graph Settings dialog box. (Clicking OK implements your current selection and exits the dialog box.)

Forecast Pro TRAC supports two types of graphs—time series and year over year. Select “Year over Year”. Notice that the titles that we had specified for the time series graph have disappeared. Select “Time Series”. Notice that the titles are back. Because the graph types are distinctly different, Forecast Pro TRAC maintains their formatting separately.

When you are viewing a time series graph, you have the option of displaying all of the data in a nonscrollable display or “zooming in” and graphing a subset of the data. Remove the check from the “All” option and click OK. Notice that the graph now displays 36 data points and is scrollable. Use the horizontal scrollbar to scroll through the display.

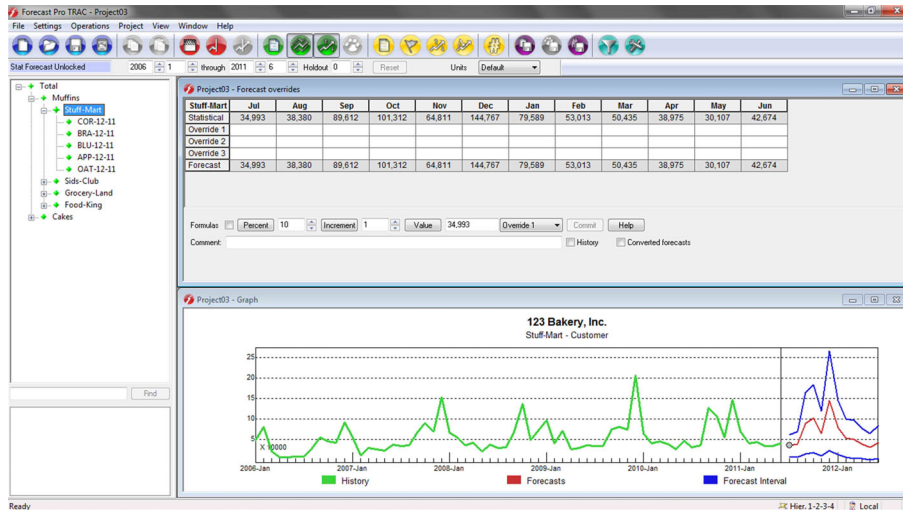


Return to the Components tab of the Graph Settings dialog box, select “All” and click Apply. Then move to the Layout tab. The tab allows you to select the graph style you wish to display and choose custom line colors and widths. Experiment with the settings. After you are comfortable with their operation edit the settings so they match the ones shown above and click OK.

Overriding the Forecasts

There will undoubtedly be times when you want to judgmentally override the statistical forecasts. For instance you may know of a large incoming order and need to change a number or two. Forecast Pro TRAC allows you to make these changes quickly and easily.

Click the green Override Forecasts icon () or select **View>Overrides** from the menu. Your display should look like the one below.



The Override view provides several different ways to override the statistical forecasts. You can enter values in individual override cells, you can select a range of cells and use the Percent, Increment or Value buttons to write the desired overrides to the target override row or you can use the mouse to drag points on the graph. If a time period has overrides in both Override 1 and Override 2, Override 2 will take precedence.

Highlight the Statistical values for August and September of 2011. Set the Percent box to 12% and click the Percent button. Notice that the proposed overrides are written to the target row indicated to the immediate left of the Commit button—in this example, Override 1. Notice also that the values displayed in the Forecast row have not changed—this is because we have not yet committed to the overrides. Uncommitted overrides are displayed in red, both in the override row and on the graph.

Click the Commit button to accept the overrides. Notice that the formerly uncommitted values in the override row change to black, the Forecast row is updated and the graph is updated.

Notice also that the icon for *Total>Muffins>Stuff-Mart* on the Navigator now appears in red and the icons for *Total>Muffins* and *Total* in yellow. A red Navigator icon signifies that an override has been made to the item. If a group icon appears in yellow it signifies that an override has been made to a variable lower down that branch of the hierarchy.

When you make an adjustment to an item in a hierarchy, Forecast Pro TRAC will automatically reconcile the entire hierarchy to reflect the change. Thus when we made our override to *Total>Muffins>Stuff-Mart* this impacted the groups above our selection and all groups and items below our selection. The Reference section of this manual describes how the reconciliation is performed.

Important: *If you restrict your overrides to a single level of the hierarchy, the reconciliation process is simple and intuitive. We strongly urge you to limit your overrides to a single level if at all possible.*

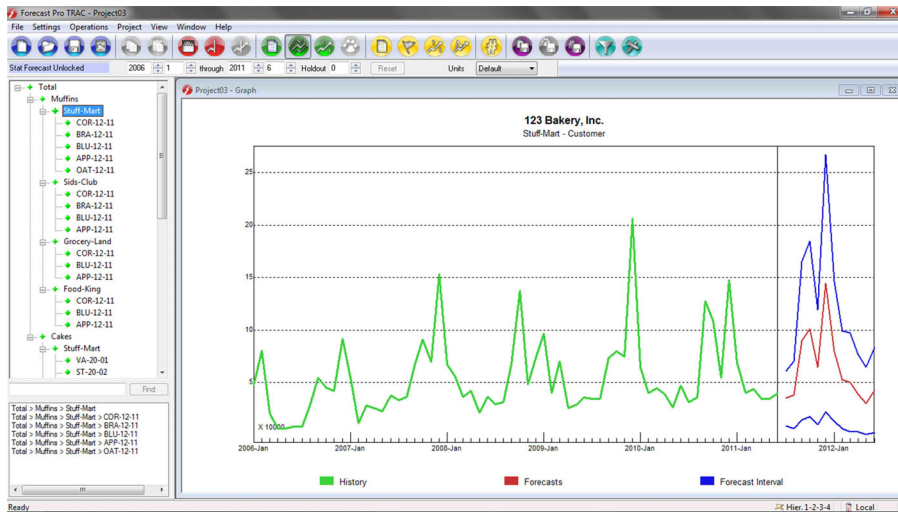
We have illustrated the basics of the override facility. There is a considerable amount of additional functionality, including the ability to associate comments with override cells, the ability to add and remove override rows, the ability to name override rows, the ability to make overrides on the graph using your mouse, the ability to enter overrides as formulas, the ability to view the history and the ability to make incremental adjustments to the Statistical Forecast row rather than overriding the values. All of this functionality is described in the Reference section of this manual.

Turn off the Override view by clicking its green icon (.

Working With a Hot List

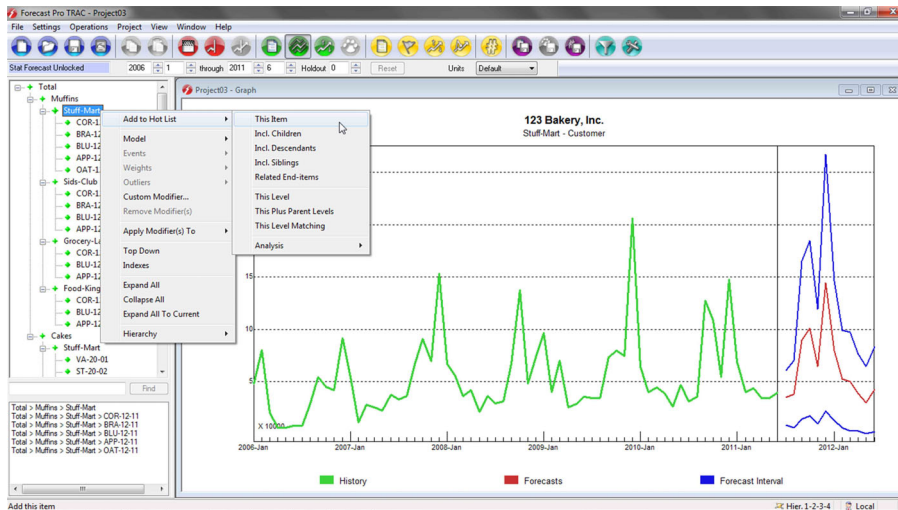
The *Hot List* is the (currently empty) box, located in the bottom left-hand corner of the screen, below the Navigator. Placing items on the Hot List allows you to efficiently navigate and work with a subset of your items.

Right click on the Navigator to invoke the Navigator's context menu. Select **Expand All** to fully expand the Navigator. Drag *Total>Muffins>Stuff-Mart* from the Navigator into the Hot List area. Your display should now look like the one below.



Click on the different items in the Hot List and notice that as you do so, the Navigator selection and views are immediately updated to match your selection.

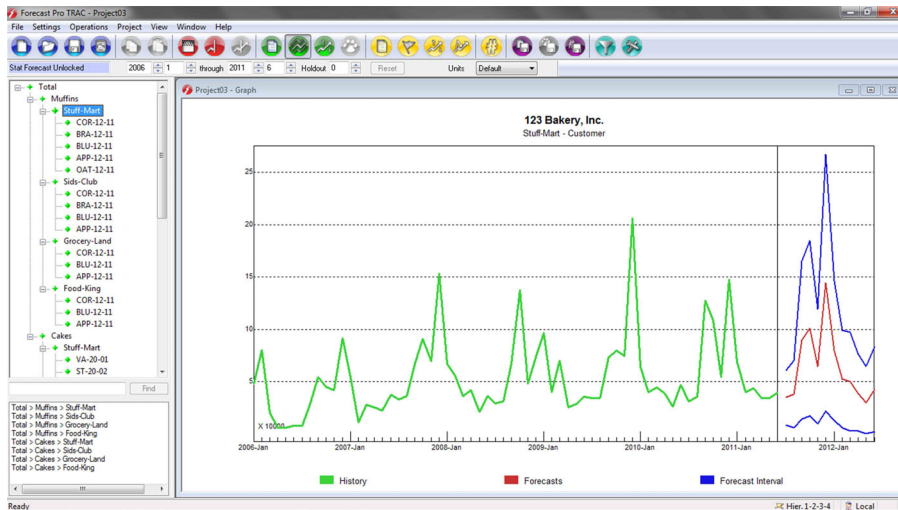
Right click in the Hot List area to call up the Hot List's context menu. Notice that there are a full range of options to control how Hot List items are displayed and to remove items. Select **Clear** to clear the Hot List.



Now select *Total>Muffins>Stuff-Mart* on the Navigator and right click to bring up the Navigator’s context menu and select **Add to Hot List**. Notice that there is a full range of options to add items to the Hot List. *Children*, *Parents* and *Siblings* refer to one level down on the current branch, one level up on the current branch and the same level on the current branch respectively. In the “Analysis” menu selection, *Overrides* refer to items with direct overrides and *Affected* refers to items with indirect overrides (i.e., items where a direct override elsewhere in the hierarchy changed the items’ forecast).

Experiment with adding and removing items from the Hot List until you are comfortable with its operation.

Clear the Hot List, select *Total>Muffins>Stuff-Mart* on the Navigator, invoke the Navigator’s context menu and select **Add to Hot List > This Level**. Your screen should now match the display below.



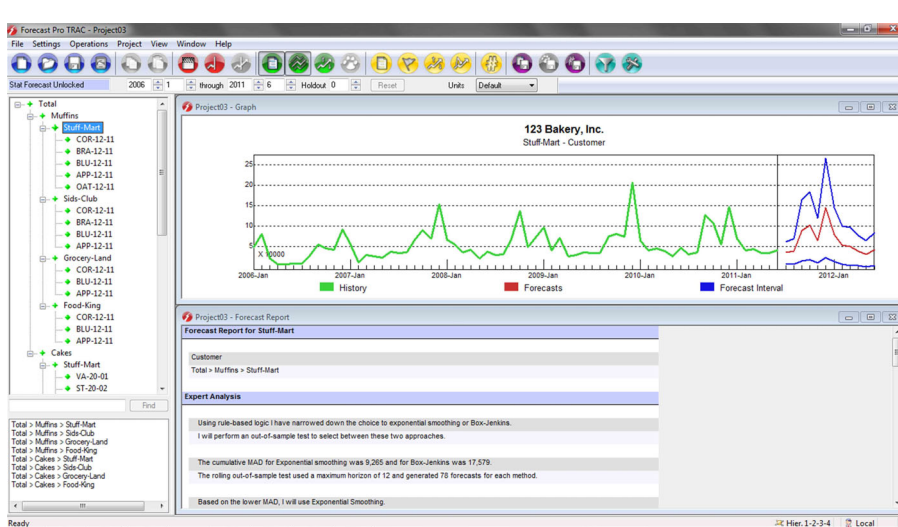
Saving the Forecasts

Forecast Pro TRAC provides two different ways to output your forecasts. Each is described below.

The *Numeric Output file(s)* is used to save the forecasts and other information in a concise format. If you plan to import the forecasts into a database or a planning system—this is the file you should use. You have a great deal of control over the content and format of this file and can save it in text, spreadsheet, ODBC, or XML formats.

The *Forecast Report* is an Excel file containing a separate forecast worksheet for each item forecasted. Each report worksheet will contain the currently displayed graph for the item and the currently displayed forecast report. Thus, in addition to allowing you to view information on screen, the graph view and the forecast report view also are used to design the Excel-based forecast report.

Click **Project>Export**. Notice that both of these output files can be saved for either all items forecasted or just the items on the current Hot List.



Arrange your display so that it includes both the Graph view and the Forecast Report view. Right click on the Hot List to display its context menu and select **Save Forecast Report**. A dialog box will appear allowing you to name the Excel file. Name the file *Hot List Report* and save it.

Examine *Hot List Report.xls* in Excel and verify that it contains a worksheet for each item on the Hot List and that the contents and format matches the currently displayed graph and report views.

Close the Graph window and the Forecast Report window. Open the Numeric Output Preview window by clicking the yellow Preview Numeric Output icon (📊).

Forecast Pro TRAC - Project03

File Settings Operations Project View Window Help

Stat Forecast Unlocked 2006 through 2011 6 Holdout 0 Units Default

Project03 - Numeric Output

Total	Category	Customer	SKU	Record Type	Description	Units	2011-Jul	2011-Aug	2011-Sep	2011-Oct	2011-Nov	2011-Dec	2012-Jan	2012-Feb	2012-Mar
Total Muffins	Stuft-Mart	COR-12-11	Point forecasts	CASE - 12 count Corn Muffins	Default	6,544.79	8,458.83	16,457.16	19,714.75	18,317.55	36,745.69	23,071.52	11,233.73	14,142.12	
Total Muffins	Stuft-Mart	BRA-12-11	Point forecasts	CASE - 12 count Bran Muffins	Default	5,815.79	7,793.47	27,190.36	26,838.83	6,186.96	35,246.22	10,922.77	10,792.16	9,864.4	
Total Muffins	Stuft-Mart	BLU-12-11	Point forecasts	CASE - 12 count Blueberry Muffins	Default	15,771.07	14,481.00	21,489.00	20,289.00	15,371.00	23,851.00	18,662.00	19,127.00	20,442.00	
Total Muffins	Stuft-Mart	APP-12-11	Point forecasts	CASE - 12 count Apple Muffins	Default	5,527.30	5,624.48	7,475.70	7,313.81	7,703.24	9,825.67	7,068.69	7,292.36	8,178.00	
Total Muffins	Stuft-Mart	OAT-12-11	Point forecasts	CASE - 12 count Oatmeal Muffins	Default	1,539.22	2,022.17	17,083.53	27,155.26	17,222.89	39,086.25	20,393.74	4,567.44	1,068.1	
Total Muffins	Sids-Club	COR-12-11	Point forecasts	CASE - 12 count Corn Muffins	Default	7,050.28	7,050.28	7,050.28	7,050.28	7,050.28	7,050.28	7,050.28	7,050.28	7,050.28	
Total Muffins	Sids-Club	BRA-12-11	Point forecasts	CASE - 12 count Bran Muffins	Default	7,050.96	7,512.02	7,640.78	7,676.73	7,686.78	7,689.58	7,690.36	7,690.58	7,690.6	
Total Muffins	Sids-Club	BLU-12-11	Point forecasts	CASE - 12 count Blueberry Muffins	Default	5,544.37	7,329.77	12,026.10	10,601.84	6,750.41	16,090.33	10,537.60	5,553.18	5,539.0	
Total Muffins	Sids-Club	APP-12-11	Point forecasts	CASE - 12 count Apple Muffins	Default	5,318.17	7,949.04	12,587.32	11,086.70	5,662.80	14,653.59	19,547.83	8,590.81	6,963.2	
Total Muffins	Grocery-Land	COR-12-11	Point forecasts	CASE - 12 count Corn Muffins	Default	4,124.80	4,853.74	8,082.54	10,951.55	9,956.92	10,744.28	7,396.66	6,878.80	7,836.0	
Total Muffins	Grocery-Land	BLU-12-11	Point forecasts	CASE - 12 count Blueberry Muffins	Default	3,672.28	4,075.40	6,624.76	3,715.25	4,263.92	8,017.03	4,007.41	3,981.86	4,060.5	
Total Muffins	Grocery-Land	APP-12-11	Point forecasts	CASE - 12 count Apple Muffins	Default	5,615.60	6,904.83	11,602.94	7,950.69	5,802.30	10,240.27	5,300.30	4,984.89	7,664.2	
Total Muffins	Food-King	COR-12-11	Point forecasts	CASE - 12 count Corn Muffins	Default	5,089.47	5,118.81	31,836.97	33,392.75	27,085.10	35,900.78	32,652.18	29,618.48	11,609	
Total Muffins	Food-King	BLU-12-11	Point forecasts	CASE - 12 count Blueberry Muffins	Default	15,201.36	14,987.88	25,164.64	15,974.99	13,081.02	25,727.71	10,688.96	15,686.70	20,171	
Total Muffins	Food-King	APP-12-11	Point forecasts	CASE - 12 count Apple Muffins	Default	16,285.30	16,285.30	16,285.30	16,285.30	16,285.30	16,285.30	16,285.30	16,285.30	16,285	
Total Cakes	Stuft-Mart	VA-20-01	Point forecasts	CASE - 20 oz. Vanilla Layer Cake	Default	10,351.86	10,971.16	9,488.22	6,126.31	8,539.63	10,141.75	7,134.37	5,287.31	12,548	
Total Cakes	Stuft-Mart	ST-20-02	Point forecasts	CASE - 20 oz. Strawberry Pound Cake	Default	1,914.44	1,914.44	1,914.44	1,914.44	1,914.44	1,914.44	1,914.44	1,914.44	1,914.4	
Total Cakes	Stuft-Mart	LF-20-02	Point forecasts	CASE - 20 oz. Low-Fat Pound Cake	Default	3,451.17	3,595.98	4,971.71	3,720.90	2,949.68	4,594.96	5,394.88	3,813.00	4,855.8	
Total Cakes	Stuft-Mart	LE-20-02	Point forecasts	CASE - 20 oz. Lemon Pound Cake	Default	3,189.59	3,362.40	3,879.73	2,590.08	3,088.05	3,378.63	3,162.50	2,886.09	3,681.3	
Total Cakes	Stuft-Mart	CO-20-01	Point forecasts	CASE - 20 oz. Coconut Layer Cake	Default	1,915.08	2,123.91	2,818.13	1,915.08	2,193.25	2,249.39	2,513.96	1,709.51	2,827.8	
Total Cakes	Stuft-Mart	CH-20-01	Point forecasts	CASE - 20 oz. Chocolate Layer Cake	Default	13,502.78	15,238.44	13,324.07	10,964.03	12,494.45	14,223.63	11,451.83	9,475.05	16,625	
Total Cakes	Stuft-Mart	CA-20-01	Point forecasts	CASE - 20 oz. Carrot Layer Cake	Default	14,196.58	13,175.21	10,675.96	8,173.92	10,809.08	10,499.85	8,621.23	6,331.71	13,921	
Total Cakes	Stuft-Mart	BU-20-02	Point forecasts	CASE - 20 oz. Butter Pound Cake	Default	5,213.17	4,882.29	7,287.90	4,063.00	4,292.63	6,301.40	5,220.16	4,425.19	4,604.9	
Total Cakes	Sids-Club	VA-20-01	Point forecasts	CASE - 20 oz. Vanilla Layer Cake	Default	6,146.20	6,429.32	6,539.42	4,852.78	3,872.87	5,253.17	4,601.58	3,838.98	4,465.8	
Total Cakes	Sids-Club	LF-20-02	Point forecasts	CASE - 20 oz. Low-Fat Pound Cake	Default	15,085.52	15,939.82	11,949.64	9,287.02	10,211.30	14,147.65	7,242.24	12,553.38	19,766	
Total Cakes	Sids-Club	CO-20-01	Point forecasts	CASE - 20 oz. Coconut Layer Cake	Default	8,149.59	9,254.67	9,823.54	6,467.82	8,711.87	6,744.63	6,528.81	5,448.08	6,903.8	
Total Cakes	Sids-Club	CH-20-01	Point forecasts	CASE - 20 oz. Chocolate Layer Cake	Default	6,020.59	5,302.97	5,834.11	6,139.07	4,842.95	6,066.36	3,303.77	3,149.82	6,826.5	
Total Cakes	Sids-Club	CA-20-01	Point forecasts	CASE - 20 oz. Carrot Layer Cake	Default	7,201.53	8,412.32	8,956.05	6,537.85	5,365.70	6,661.13	6,782.85	5,858.68	8,578.3	

The Numeric Output Preview window displays the contents and format of the currently specified Numeric Output file. Click **Settings>Numeric Output Design**.

Numeric Output Design

Output Format Time Series Data Model and Statistics

Output

Forecast file prefix: 1

☐ Default units only

☐ Default hierarchy only

☐ Include items without forecasts

Select filter attributes to display:

Set as Default

Layout

Data mode: Xs

Orientation: Horizontal

☒ Headings

☒ Exclude group totals

☐ Exclude end items

☒ Single output file

☒ Break record up into lines

☐ Transactions

Text Format

Field delimiter: Space

Record delimiter: Enter

Decimal separator: Period

☒ Test delimiters

☐ Include placeholders

Pareto

☐ List

☐ Percent of Total: 2

☐ Rank

☐ Cumul. Percent: 2

OK Cancel Apply Help

This dialog box allows you to design the Numeric Output. The first tab allows you to specify whether you wish the output to use the currently displayed units and hierarchy or always output the default units and hierarchy. It also allows you to specify the file type and control the layout. The Time Series Data tab and the Model and Statistics tabs allow you to specify the contents.

Explore the options on this dialog box. If you are unsure of the function of any selection click the Help button for a description.

The settings you select will be used for your current project. If you click the Set as Default button on the displayed tab, the current settings will also be saved as the default to use for all new projects. Exit the dialog box.

Click the purple Save Numeric Output icon (). A dialog box will appear allowing you to name the file. Name the file *Test Numeric Output* and save it. Examine the file and verify that its contents and format matches those specified in the Numeric Output Design dialog box.

Saving the Project

Our final step will be to save our current forecasting session as a *project*. Saving a forecast project allows you to return later and pick up where you left off or to share the session with others.

Select **File>Save As** and save the project using the name *test project*.

Be aware that a forecast project saves the data, forecasts and overrides that are currently in memory. If you update your input data files after saving a project, when you reopen the project you'll have the option of either opening the project as it existed when you saved it or reading in the updated data and revising the forecasts.

Exit the program.

This concludes Lesson 1.

Lesson 2

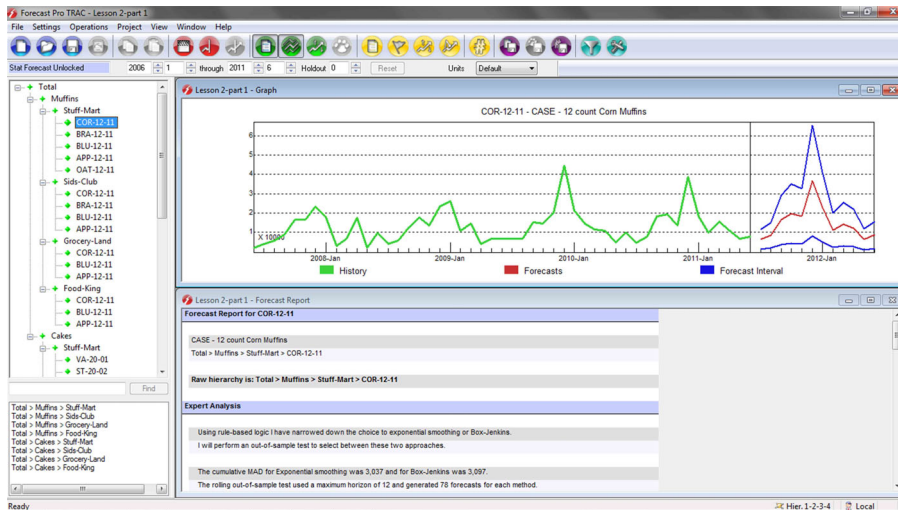
Working with Conversions and Alternative Hierarchies

In this lesson we will explore how Forecast Pro TRAC allows you to view and work with your forecasts in different units of measure and different hierarchical structures.

The Default State

When you set up your data for Forecast Pro TRAC the units of measure you use for the historic demand and the hierarchy that you define are referred to as the *default* units of measure and the *default* hierarchy respectively. Together they comprise the *default state*.

Let's illustrate this with an example. Start Forecast Pro TRAC. Select **File>Open** and open the project *Lesson 2-part 1*.



This project uses the 123 Bakery data that we explored in Lesson 1. As you may recall, the data were read in from an Excel file called *123 Bakery.xls*. The spreadsheet contains sales for the different products measured in cases. Thus, cases is our default unit of measure. The spreadsheet also defines the default hierarchy, which in this example has four levels—a total level, a category level (consisting of Muffins and Cakes), a customer level and a SKU level.

The combination of our default units of measure displayed in our default hierarchy is referred to as our default state. Notice that “Default” is currently displayed on the dialog bar’s Units drop down box and that in the lower right hand corner of the status bar the default hierarchy is listed as “1-2-3-4”.

Locked and Unlocked Modes

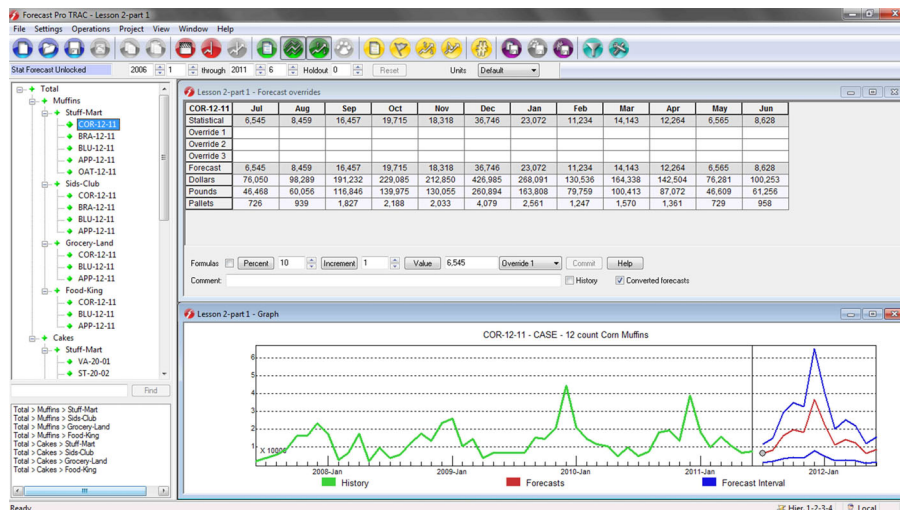
Changing the display units and/or altering the hierarchy should only be done after you have established the statistical forecasts including any custom modeling options. These operations will “lock” the statistical forecasts. When the statistical forecasts are locked, you are no longer able to change the statistical forecasting methods used to generate the statistical forecasts and the sections of the Forecast Report that pertain to the statistical modeling (i.e., Expert Analysis, Model Details, Within-Sample Statistics, Out-of-Sample Tests and Outliers) are omitted.

Working with Alternative Units of Measure

Forecast Pro TRAC allows you to define item-level conversion factors (i.e., multipliers) which can be used to display the history and forecasts in alternative units.

Forecast Pro TRAC uses a second input file to bring in item-level conversion factors (and/or exception report thresholds). When Forecast Pro TRAC reads in a data file it looks for a corresponding secondary file. The convention used to associate a secondary file with a data file, is to use the same filename with “_Secondary” appended to it. In our current example the input filename is *123 Bakery.xls* and the corresponding secondary file is *123 Bakery_Secondary.xls*. The creation of these files is fully documented in the Reference section of this manual.

In our current example we defined three alternative units of measure in the secondary file, *dollars*, *pounds* and *pallets*.



Turn off the Forecast Report view, turn on the Override Forecasts view and check the box for the “Converted forecasts” option. Your display should now look like the one above.

Notice that the “Converted forecasts” option adds additional rows to display the forecasts in the alternative units of measure. This allows you to enter changes in the currently displayed units (in this example the default—cases) and immediately see the impact on the other units of measure. Turn off these display rows by removing the check mark from “Converted forecasts”.

Open the Units drop down box on the dialog bar and select Dollars.

A warning message informs you that this action will lock the statistical forecasts, move all current overrides into the inherited override row and discard all current comments (we will discuss the treatment of overrides later in this lesson). Click OK to continue.

Notice that the history and forecasts are now displayed in dollars and the status box above the Navigator reads “Stat Forecast Locked”.

You are now working with dollars. Any overrides that you make to the forecasts, reports that you generate, etc. will be in dollars.

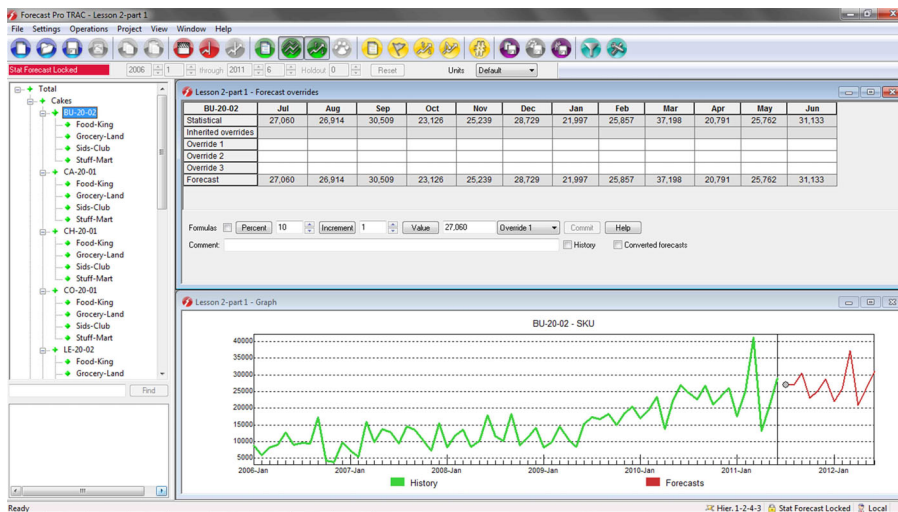
Changing the Hierarchy

In our current example we have a 4-level hierarchy. As we commented previously, because we are currently viewing the default hierarchy (i.e., the one defined in the historic data file) the status bar lists the hierarchy as 1-2-3-4.

Select *Total>Muffins>Stuff-Mart* on the Navigator. This displays the total muffin sales for Stuff-Mart. The “children” (i.e., component series) of this group are the SKU-level muffin sales to Stuff Mart.

What if we wanted to view or adjust total sales for a given SKU *across* customers? The current hierarchy is not set up to do this. To accomplish this we need to reorganize our hierarchy so that the SKUs appear on level 3 of the hierarchy and the customers appear on level 4.

Right click *Total>Muffins>Stuff-Mart* on the Navigator to invoke the context menu. Select **Hierarchy>Demote**. Fully expand the Navigator and select BU-20-02. Your display should look like the one below.



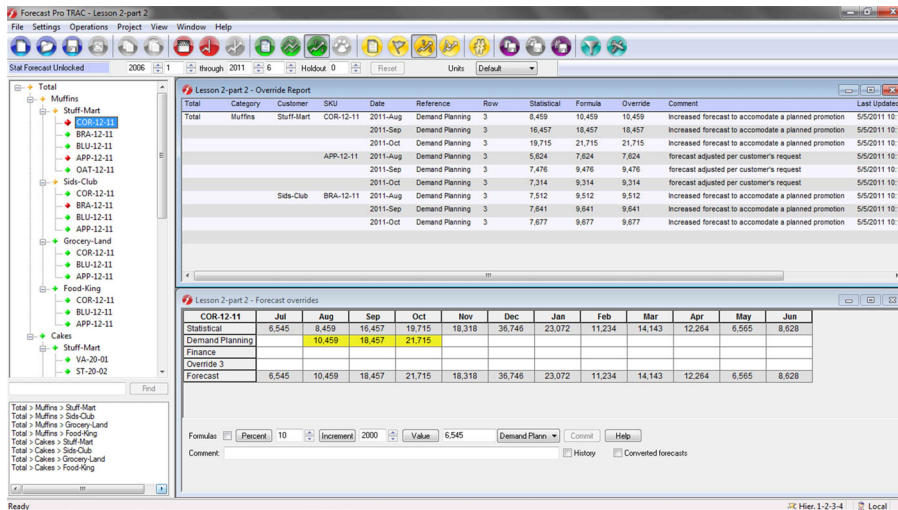
Notice that by demoting level 3 of the default hierarchy we have created a new hierarchy that allows us to view and adjust total sales by SKU across customers. The status bar lists this new hierarchy as 1-2-4-3 to reflect the fact that we demoted the original level 3.

Experiment with the hierarchy adjustment and conversion options until you are comfortable with their operation. Then select **File>Close** to close the project. *When prompted, DO NOT save the changes to the Lesson 2-part 1 project.*

Working with Override Sets

In this section we will explore how Forecast Pro TRAC maintains your overrides when you change units or modify the hierarchy.

Select **File>Open** and open the project *Lesson 2-part 2*.



The top window is displaying the Override Report view. This view shows all current overrides in the project. The Override Report view is turned on and off using the yellow View Override Report icon ()

Notice that this project is in the default state (i.e., default units, default hierarchy), the statistical forecasts are unlocked and overrides exist for three of the SKUs.

The override view allows you to enter overrides and comments in specific cells on the override grid. We refer to these overrides as appearing *in-place*.

When you change units and/or change the hierarchy, it is not always possible to maintain the in-place overrides. This is due to factors such as the item or group that had an in-place override may no longer exist after you change the hierarchy or that changing the units would result in a different forecast allocation across the hierarchy.

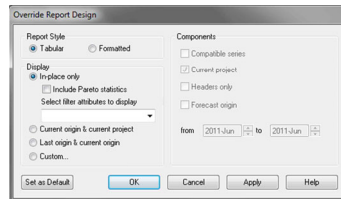
To avoid these problems and to insure that the final forecasts will remain consistent regardless of the hierarchy or units you are viewing, Forecast Pro TRAC will move the in-place overrides into a special override row labeled *Inherited overrides* prior to performing hierarchy changes and/or conversions.

Select the Units drop-down box on the dialog bar and select Dollars.

A warning message informs you that this action will lock the statistical forecasts, move all current overrides into the inherited override row and discard all current comments. Click OK to continue.

Notice that the in-place overrides have disappeared, the Override Report is now empty and that there is now a display row labeled *Inherited overrides* that contains the changes.

Right click on the Override Report to invoke its context menu and select **Override Report Design**.



Notice that the Override Report is currently set to display in-place overrides only. Since there are no current in-place overrides the display is empty.

Select “Current origin & current project” and click OK. This will display all overrides associated with the current project during the current forecast period.

Total	Category	Customer	SKU	Status	Date	Reference	Row	Formula	Override	Comment	Last
Forecast Origin: 2011-Jun (1) Hierarchy: 1-2-3-4 Units: Default Last Updated: 5/5/2011 10:12:30 AM											
Total	Muffins	Stuff-Mart	COR-12-11	Saved	2011-Aug	Demand Planning	3	10,459	10,459	Increased forecast to accommodate a planned promotion	5/5G
				Saved	2011-Sep	Demand Planning	3	18,457	18,457	Increased forecast to accommodate a planned promotion	5/5G
				Saved	2011-Oct	Demand Planning	3	21,715	21,715	Increased forecast to accommodate a planned promotion	5/5G
Total	Muffins	Stuff-Mart	APP-12-11	Saved	2011-Aug	Demand Planning	3	7,624	7,624	forecast adjusted per customer's request	5/5G
				Saved	2011-Sep	Demand Planning	3	9,476	9,476	forecast adjusted per customer's request	5/5G
				Saved	2011-Oct	Demand Planning	3	9,314	9,314	forecast adjusted per customer's request	5/5G
Total	Muffins	Sids-Club	BRA-12-11	Saved	2011-Aug	Demand Planning	3	9,512	9,512	Increased forecast to accommodate a planned promotion	5/5G
				Saved	2011-Sep	Demand Planning	3	9,641	9,641	Increased forecast to accommodate a planned promotion	5/5G
				Saved	2011-Oct	Demand Planning	3	9,677	9,677	Increased forecast to accommodate a planned promotion	5/5G
Forecast Origin: 2011-Jun (2) Hierarchy: 1-2-3-4 Units: Dollars Last Updated: 5/23/2011 4:15:35 PM											

Lesson 2-part 2 - Forecast overrides												
COR-12-11	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Statistical	76,050	98,289	191,232	229,085	212,850	426,985	268,091	130,536	164,338	142,504	76,281	100,253
Inherited overrides												
Demand Planning												
Finance												
Override 3												
Forecast	76,050	121,529	214,472	252,325	212,850	426,985	268,091	130,536	164,338	142,504	76,281	100,253

The report above displays two *override sets*. The first one captures the overrides made to the initial default state. Its header row identifies the forecast origin (i.e., last historic data point) as June of 2011, the hierarchy as 1-2-3-4 and the units as Default. The second override set's header row identifies the forecast origin as June of 2011, the hierarchy as 1-2-3-4 and the units as Dollars.

Enter the value 400,000 into the September override cell on the Finance override row and click Commit. Notice that the Override Report is updated to display your latest change.

The overrides and comments entered in every state (i.e., hierarchy/unit combination) are saved to the database as an “override set.” Override sets can be viewed in the Override Report, imported and exported to projects and loaded from the database's archive when you update your project.

If possible, it is a good practice to limit your overrides to a single state. This allows you to view all overrides in-place and vastly simplifies loading previously entered overrides when you update your project.

Exit Forecast Pro TRAC without saving changes to the *Lesson 2-part 2* project.

This concludes Lesson 2.

Lesson 3

Updating a Forecast Project

For most organizations updating the forecast is a routine operation that occurs every planning period. For instance, if the forecasts are prepared using monthly data, then each month the data are updated to include the latest observation and the forecasts are regenerated.

Forecast projects enable you to quickly update last period's forecast and give you the option of loading or not loading your previously specified forecasting models, Hot List and forecast overrides. In this lesson we will explore how this is accomplished.

Defining the Forecasting Process

An important key to implementing a successful forecasting process using Forecast Pro TRAC is to define the process upfront and make sure that everyone involved understands their role in establishing the final numbers.

Some of the more important questions to answer before you start include:

What output is required and what format should it be in?

What naming conventions should be used for data files, output files and forecast projects, where should these files be kept and how will they be backed up?

Who is authorized to enter forecast overrides, at what level(s) are they entered and in what units are they entered?

What are the steps required to update our forecasts each planning period?

Depending on the complexity of your forecasting process and the number of individuals involved, it may be useful to document the decisions made and the steps required to update the forecasts each planning period.

Step One: Updating Your Data Files

Consider the following situation. We work for the 123 Bakery. We have defined an extremely simple forecasting process where the forecasts are generated and adjusted by one individual. All adjustments are made to the SKU-level data in base units and in the base hierarchy. The projects are saved with the statistical forecast unlocked (i.e., we never change states).

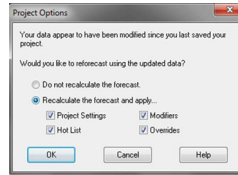
It is early June 2011 and we have historic demand data that starts in 1/2006 and ends in 5/2011. Thus, our first forecast period will be June 2011. We use Forecast Pro TRAC to create our forecasts and then we save a forecast project named *Lesson 3-June 2011*.

Now imagine that a month passes by. We now have our sales figures for June and we update our historic data files.

This is accomplished externally to Forecast Pro TRAC. It may entail running a data extraction routine to generate the new files, updating your spreadsheets by hand, or some other process to update the historical data files.

Step Two: Opening Your Forecast Project

Start Forecast Pro TRAC, select **File>Open** and select the project, *Lesson 3-June 2011*. The dialog box below appears.



Forecast Pro TRAC has noticed that the forecast project *Lesson 3-June 2011* and the data file *123 Bakery.xls* are out-of-sync. It is giving you two options.

If you select “Do not recalculate the forecast”, Forecast Pro TRAC will open the project and restore the forecasts session as it existed when it was saved last month. *It will not read the new data. It will not revise the forecasts.*

Select “Do not recalculate the forecast” and click OK to verify this. Notice that the historic data ends in May of 2011 and the first forecast period is June 2011.

Now select **File>Open** and select the project, *Lesson 3-June 2011* again. The data file and project are still out of sync so the dialog box reappears.

If we now select “Recalculate the forecast and apply”, Forecast Pro TRAC will read in the revised data, generate new forecasts and (if you request them) restore the project settings, Hot List, forecast modifiers and overrides.

Select “Recalculate the forecast and apply” and click OK. Expand the Navigator and select *Total>Muffins>Stuff Mart>BRA-12-11*.

Notice that the historic data now ends in June 2011 and the first forecast period is July 2011. Notice also that Forecast Pro TRAC has restored the Hot List, forecast modifiers and overrides and that the overrides correctly reflect the new dates.

At this point we have generated a new forecast. Let’s save this project using a different name so that we can retain both our *Lesson 3-June 2011* project and

our new July forecasts. Select **File>Save As** and name the project *Lesson 3-July 2011*.

Step Three: Saving Your Work

If this was a real forecasting session we would now review the new forecasts, add any needed overrides, adjust the forecasting models as appropriate, share the forecast project with others, etc. until we establish the final July forecast.

Once we've established the final forecast we would save our final project file for the July forecast and save any desired output files.

Exit Forecast Pro TRAC using **File>Exit**.

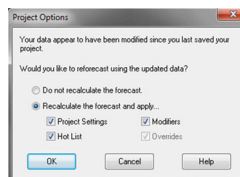
Working with Override Sets

In our last example we updated a very simple project that was saved when the statistical forecasts were unlocked. This means that the person who created the project never changed states (i.e., they did not change units nor change the hierarchy). When you update a project that was saved in an unlocked state, Forecast Pro TRAC allows you to automatically load the overrides.

If you update a project that was saved in a locked state then you will have to explicitly load any override sets that you wish to apply using **Project>Import>Archived Overrides**. Let's see how this works.

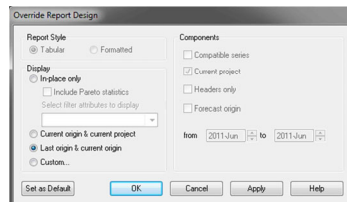
The project we will use is very similar to the project we looked at previously; the only difference is that it contains overrides both in the base state and after converting to dollars. Thus, the project was saved when the statistical forecasts were locked.

Start Forecast Pro TRAC, select **File>Open** and select the project *Lesson 3-part 2*. The dialog box below appears.



Select “Recalculate the forecast and apply”. Notice that the option to automatically load the overrides is greyed out. This is because the project was saved in a state where the statistical forecasts were locked. Click OK. Forecast Pro TRAC will read in the revised data and generate new forecasts.

Click on the yellow View Override Report icon (📄) to open the override report view. Right click the override report view to bring up its context menu and select **Override Report Design**.



Select “Last origin & current origin” and click OK. This will display the override sets associated with the current forecast period and the previous forecast period. This is a useful display to view when you are loading override sets.

Total	Category	Customer	SKU	Status	Date	Reference	Row	Formula	Override	Comment	Last Updated
Forecast Origin: 2011-May (1) Hierarchy: 1-2-3-4 Units: Default Last Updated: 5/6/2011 10:09:08 AM											
Total	Muffins	Stuff-Mart	BRA-12-11	Saved	2011-Jul	Override 1	3	6,875	6,875	Increased for a planned promotion	5/6/2011 10:08:48 AM
Total	Muffins	Stuff-Mart	BRA-12-11	Saved	2011-Aug	Override 1	3	9,375	9,375	Increased for a planned promotion	5/6/2011 10:08:48 AM
Total	Muffins	Stuff-Mart	BRA-12-11	Saved	2011-Sep	Override 1	3	31,511	31,511	Increased for a planned promotion	5/6/2011 10:08:48 AM
Total	Muffins	Side-Club	BRA-12-11	Saved	2011-Jul	Override 1	3	8,464	8,464	Increased for a planned promotion	5/6/2011 10:09:07 AM
Total	Muffins	Side-Club	BRA-12-11	Saved	2011-Aug	Override 1	3	8,770	8,770	Increased for a planned promotion	5/6/2011 10:09:07 AM
Total	Muffins	Side-Club	BRA-12-11	Saved	2011-Sep	Override 1	3	8,853	8,853	Increased for a planned promotion	5/6/2011 10:09:07 AM
Forecast Origin: 2011-May (2) Hierarchy: 1-2-3-4 Units: Dollars Last Updated: 5/6/2011 10:10:16 AM											
Total	Muffins	Stuff-Mart	BRA-12-11	Saved	2011-Aug	Override 2	4	120,000	120,000	Raised the forecast to 120K	5/6/2011 10:09:59 AM
Total	Muffins	Side-Club	BRA-12-11	Saved	2011-Aug	Override 2	4	120,000	120,000	Raised the forecast to 120K	5/6/2011 10:10:15 AM
Forecast Origin: 2011-Jun (1) Hierarchy: 1-2-3-4 Units: Default Last Updated: 5/6/2011 10:26:50 AM											

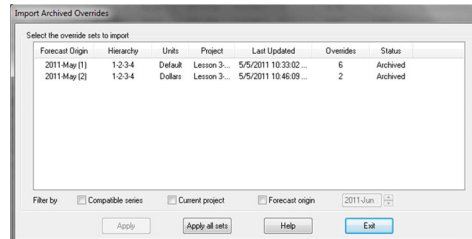
Lesson 3-part 2 - Forecast overrides												
BRA-12-11	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Statistical	5,611	7,793	27,106	26,839	6,196	35,246	10,973	10,792	6,564	2,243	2,990	4,542
Override 1												
Override 2												
Override 3												
Forecast	5,611	7,793	27,106	26,839	6,196	35,246	10,973	10,792	6,564	2,243	2,990	4,542

Notice that there are three override sets displayed. The first set’s origin is May (i.e., the last historic data point was May, first forecast was June) and the overrides were made in base hierarchy (1-2-3-4) and base units (default). The

second set's origin is also May and the overrides were also made in base hierarchy, but the units were dollars.

The third set's origin is June. It is currently empty since no overrides have been entered nor have any override sets been loaded.

Select **Project>Import>Archived Overrides**.



The Import Archived Overrides dialog box allows you to load any override set that is in the Forecast Pro TRAC database. In our example, the two May-origin override sets are the only entries in the database.

The “Apply all sets” button will apply all override sets currently being displayed. The Apply button can be used to load specific override sets one at a time.

In our example, “Apply all sets” would load the first set (which was made in base state) then convert to dollars and load the second set. Since converting to dollars requires locking the forecasts, if you select “Apply all sets” in our current example you will be in locked mode after the overrides are loaded.

Let's say that our forecasting process calls for the forecaster to update the statistical forecasts, enter overrides in base state and then save the revised project which then goes to finance, who converts to dollars and makes additional changes.

If this was our process and we were the forecaster, we'd probably want to begin by restoring the override set we saved last forecast period.

Click on the first override set to select it. Click Apply to load the override set. Click Exit to exit the Import Archived Overrides dialog box. Notice that the overrides have been loaded and that since these overrides were made in base state, the statistical forecasts are unlocked.

As you can see, updating your forecasts becomes considerably more complex when there are multiple override sets involved. For this reason, we recommend that you create a forecast process that uses as few override sets as possible. Ideally, you'd limit your overrides to a single state. This allows you to view all overrides in-place and vastly simplifies loading previously entered overrides when you update your project.

Exit Forecast Pro TRAC without saving changes to the *Lesson 3-part 2* project.

This concludes Lesson 3.

Lesson 4

Collaborating With Colleagues

Corporate forecasting often requires collaboration among colleagues. Perhaps your manager wishes to review your forecasts and make a few changes. Perhaps you want to run your forecasts past the sales force who may know about pending orders. Perhaps your business has distinctly different markets that require specific individuals to work on specific markets. Whatever the reason, it is often useful to be able to work with others to establish the final forecasts.

In this lesson we will explore how Forecast Pro TRAC supports collaborative forecasting.

Stand-alone Projects vs. Team Archives

There are two different strategies for working with others using Forecast Pro TRAC—sharing stand-alone projects and linking multiple projects together using a team archive. There are pros and cons to each approach.

Sharing a stand-alone project is by far the simplest way to work with others to establish the final forecasts. Using this approach the forecaster begins by creating forecasts for all items that need to be forecasted, enters any desired

overrides and saves a forecast project—often to a network drive. The project can then be opened by anyone using Forecast Pro TRAC (Forecaster or Collaborator licenses) to review, make changes, etc. If there is a third individual who needs to review the project, that person would do so after the second individual has updated the project.

Team archives allow you to break large forecasting jobs into smaller pieces that can be worked on separately and then consolidated. To implement this approach you construct separate component projects that are all *linked* to the same Forecast Pro TRAC database (the *team archive*). After the component projects have been forecasted and saved, the team archive can be opened directly to view and manipulate the consolidated forecast.

A forecasting process that uses stand-alone projects is *much* simpler to implement and maintain than one that uses team archives. If it is not essential that your total hierarchy be broken out into smaller pieces, then sequential review of stand-alone projects is the preferred approach.

Sharing a Stand-alone Project

In this lesson we will open a forecast project that was created by someone else, review their work and make some overrides.

Providing a colleague access to your forecast project is a simple way to share your work. As long as your colleague has Forecast Pro TRAC (Forecaster license or Collaborator license), he or she can open the project and continue the session.

When you save a forecast project, Forecast Pro TRAC creates three or four files. If the project name is *Sample* the files are:

Sample.FPProj is the *project settings file*. The project settings file is an XML file containing the project settings and script definition.

Sample.db (SQLite) or *Sample.TRAC* (Access) is the primary Forecast Pro TRAC database. This is either a SQLite or Microsoft Access database file that contains information pertaining to the current forecast period and all previously archived forecasts. The 64-bit version of Forecast Pro TRAC will always use SQLite database files. The 32-bit version can use either, and you

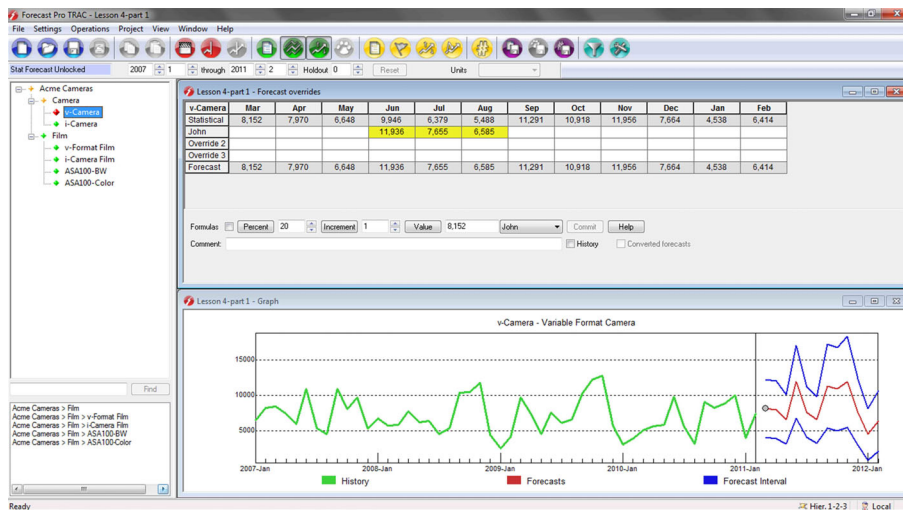
can specify which database file type to use on the Advanced tab of the Options dialog box. The setting can only be changed on a new project prior to reading in the data.

Sample.mdb is the *project tables file*. The project tables file is a Microsoft Access database file containing separate tables for the in-place overrides/comments, forecast modifiers and Hot List. This file is only created when using Access database files.

Sample.fcb is the *project snapshot file*. The project snapshot file is a binary file that saves the forecast components that are currently in memory (e.g., the forecasts, summary statistics, etc.) so that the session can be restored without having to read in the data, recalculate the forecasts, etc. This allows you to return to your session where you left off and to share the session with others.

When sharing projects with others, you need to provide all the project files.

To illustrate how to share a project we'll open up a project that is included with Forecast Pro TRAC. Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 4-part 1*. The data in this project represent sales of different types of cameras and film.



Notice that we did not define a script, read the data or click the forecast button. When we opened the forecast project, Forecast Pro TRAC restored the script, forecasts, overrides and Hot List that were present when the forecast

project was saved. The person restoring the forecast project does not even need to have access to the files containing the historical data that were used to generate the forecasts—the only thing he or she needs is the forecast project files.

Notice that the person who created the forecasts entered some overrides in June, July and August. For convenience, let's refer to the person who created this file as "John". Notice also that the background color for these cells is yellow. This indicates that the cells contain comments. Click on the June override cell to display the comment.

The comment informs us that John increased the forecast for the summer months by 20% in anticipation of a planned promotion. Let's say that we feel that a 20% lift is overly optimistic for August (the final month of the promotion) and we want to lower it to 15%. Set the target row box (located to the immediate left of the Commit button) which currently reads *John to Override 2*. Highlight the cell for August on the Statistical forecast row. Set the percent box to 15 and click the Percent button. Let's now add a comment. Highlight the cell for the override you just made, click the comment field and type, "John, I lowered the promotional lift for summer madness to 15%" and click the Commit button to accept the overrides and comment.

Now let's edit the row label *Override 2*. Click on the row label *Override 2* and right mouse click to call up the context menu. Select **Edit Row Label**. Enter *Management* and click OK. Notice that the row label has changed.

At this point we have several options on how we might save our work. For instance, we could:

- Use **File>Save as** to save a new forecast project to send back to John.

- Click the purple Save Numeric Output icon () to save an output file to submit to production, management or some other destination.

- Click the purple Save Forecast Report icon () to save formatted reports to Excel.

Exit Forecast Pro TRAC without saving changes to the *Lesson 4-part 1* project.

Working with Team Archives

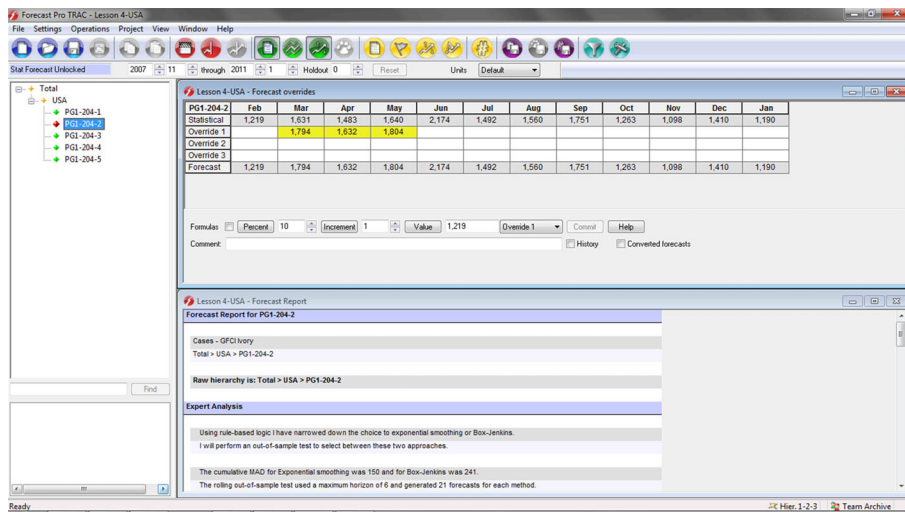
Let's consider the following example. A company sells their products in three countries—the United States, Canada and Mexico. They employ three different demand planners, each of whom is responsible for forecasting a specific country. After the demand planners have completed their forecasts, they meet with management to review the forecasts and make any required adjustments.

Accomplishing this using a single stand-alone project, would require a sequential review process. For example, assume the demand planner for the United States goes first. He or she would create a forecast project which includes all three countries and then review and make adjustments to the United States data and save the project. Next the planner for Canada would open the project, review and adjust the Canadian data, and save the revised project. Next, the planner for Mexico would open the project, review and adjust the Mexican data, and save the revised project. At this point, the demand planners' forecasts are complete and the project is ready for the management review meeting.

Clearly, there are some downsides to the above procedure. One is that the demand planners cannot work on their country-level forecasts simultaneously—they have to wait until it is their turn to do so. Another problem is that even though they are working on a single country, the project contains data and forecasts for all three countries, which makes it harder to manage and more error prone.

An alternative approach is to use a team archive. This allows you to create a separate forecasting project for each country and *link* them to a communal Forecast Pro TRAC database (i.e., a team archive). Using this approach, the three demand planners can work on their forecasts simultaneously using a project that only contains their country. When all three are done, the team archive can then be opened directly to view the consolidated forecast.

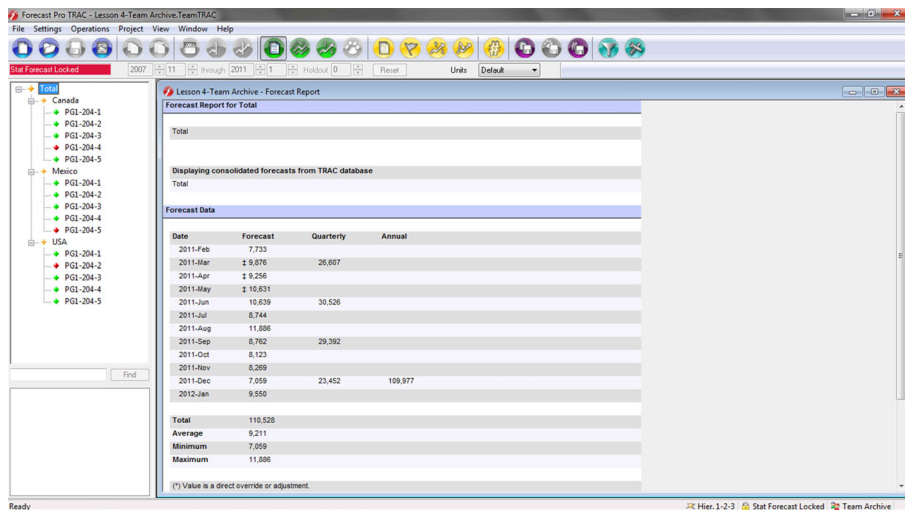
Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 4-USA*.



This is component project containing data for the United States. Notice that the bottom right corner of the status bar indicates that this project is associated with a team archive. If you hover over the team archive indicator, a tool tip appears identifying the team archive as *Lesson 4-Team Archive.Teamdb*.

Select **File>Open** and open the project, *Lesson 4-Canada*. This is also a component file connected to *Lesson 4-Team Archive.Teamdb*. Open the project *Lesson 4-Mexico* to view the third component project. As you have observed, the component projects have all been forecasted and include some overrides.

Close the current project by selecting **File>Close**. Open the team archive directly by selecting **Project>Team Archive>Open** and selecting *Lesson 4-Team Archive.Teamdb*. Open the Override view and fully expand the Navigator.



Notice that opening the team archive allows you to review and manipulate the consolidated project.

This exercise was designed to provide an introduction to team archives. Setting up and maintaining team archives is reasonably complex, so if you are planning on using team archives you should read the *Working with Team Archives* chapter of the Reference section of this manual carefully. Business Forecast Systems and Forecast Pro distributors also offer consulting services to help you establish your forecasting process.

Exit Forecast Pro TRAC without saving changes to the *Lesson 4-Team Archive.Teamdb*.

This concludes Lesson 4.

Lesson 5

Pareto Analysis and Report Filtering

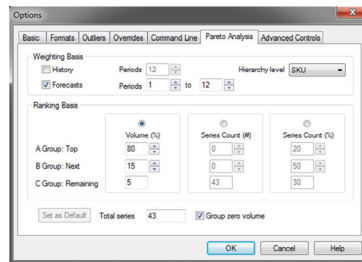
Pareto analysis is used to assign ABC classifications to your forecast items. Typically, important high volume items are categorized as type “A”, medium volume items are categorized as type “B” and slow moving items are categorized as type “C”. Thus, the code indicates the relative importance of an item and many organizations adopt different procedures for creating, reviewing and monitoring their forecasts based upon the codes.

Forecast Pro TRAC can automatically assign items into ABC categories based upon their volume. Alternatively, you can create a custom filter to define the classifications. In this lesson, we will explore both approaches and also illustrate how sorting and filtering reports on the Pareto output can be extremely useful.

Defining Pareto Classifications Within Forecast Pro

Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 5*. This project contains forecasts for the muffins and cakes data that we worked with in previous lessons.

Click the light blue Options icon () to invoke the Options dialog box and then select the Pareto Analysis tab.



The Pareto Analysis tab allows you to specify how the ABC codes should be assigned.

The Weighting Basis section allows you to indicate whether the ranking should be performed using the history, forecasts or a combination of the two and allows you to set the span for your selection. The codes are assigned to a single level of the hierarchy. The Hierarchy level drop down allows you to pick the level to use.

The Ranking Basis section allows you to set the thresholds for the classifications.

The Volume (%) option allows you to set the codes based upon the cumulative volume of each group. For example, if A is set to 80%, B is set to 15% and C is set to 5%, Forecast Pro TRAC will first rank all of the items from highest volume to lowest volume and then sequentially place the top ranked items into the A group until their cumulative volume equals or exceeds 80% of the total volume. It will then sequentially place items into the B group until the cumulative volume of the A and B items equals or exceeds 95% (80% + 15%). The remaining items (5% or less of the cumulative volume) are assigned type C.

The Series Count (#) option allows you to assign specific numbers of items to each group. For example, if you had 1,000 items and you set the A group to 100, the B group to 200 and the C group to 700—the 100 highest volume items would be assigned to group A, the next highest 200 items would be assigned to group B and the remaining 700 would be assigned to group C.

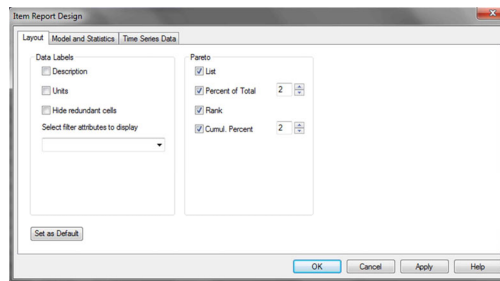
The Series Count (%) assigns the specified percentage of the total number of items you have to each group. For example if A is set to 20%, B is set to 50% and C is set to 30%, Forecast Pro TRAC will first rank all of the items from highest volume to lowest volume and then sequentially place the top ranked items into the A group until the number of A group items equals 20% of the total number of items. It will then sequentially place items into the B group until the number of B group items equals 50% of the total number of items. The remaining items (30% of the total number of series) are assigned type C.

If selected, the Group zero volume option will place any items with zero volume into group “D”.

Make sure that your settings match the ones above and click OK.

Sorting and Filtering the Pareto Output

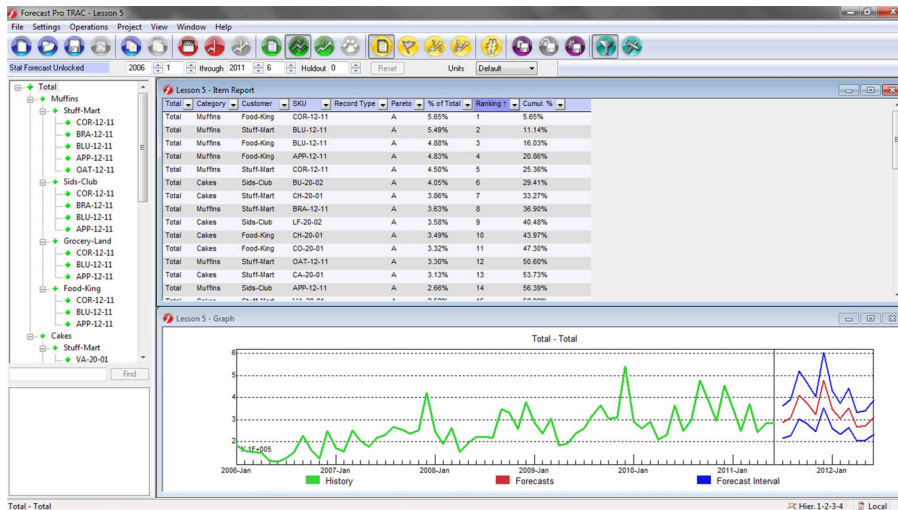
Right click on the Item Report view to display its context menu and select **Item Report Design**.



Click the checkboxes for the four Pareto fields (List, Percent of Total, Rank, Cumul. Percent) and click OK.

Notice that the Item report now includes the four fields associated with the Pareto analysis—before we discuss these fields let’s sort the report to make it easier to read.

Click the light blue Filter icon to activate the filtering and sorting mode. Click on the filter dropdown for Ranking, select Sort Smallest to Largest and click OK. Your screen should now look like the one below.



The Pareto field displays the assigned code. The % of Total field displays the percentage of total volume that the item represents. The Ranking field is self explanatory. The Cumulative % field displays the percentage of total volume for the current item plus all higher ranked items.

Scroll through the display and examine the output. Notice that the Cumulative % for the item ranked 25 is the first one to exceed 80% and that therefore the item ranked 26 is classified as a B.

Click on the filter dropdown for Pareto column, set the filter to only display type A and click OK. Examine the filtered report. Double click on the top ranked item on the report and then double click on the item ranked second. Notice that the Navigator immediately jumps to the selected item. The ability to sort, filter and navigate by double clicking on items can be very convenient when reviewing your forecasts.

If you change units of measure or shuffle the hierarchy the Pareto information will automatically update.

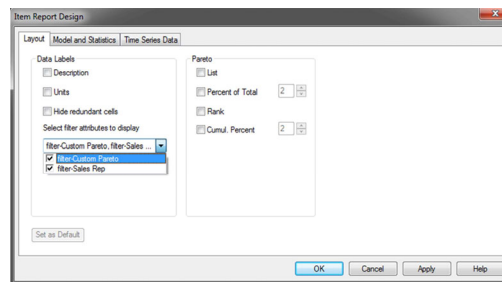
Experiment with the Pareto and filtering options until you are comfortable with their operation. When you are finished, exit the program without saving changes to the *Lesson 5* project.

Defining Pareto Classifications via a Custom Filter

Forecast Pro TRAC allows you to define custom filter fields in the secondary data file. This can be very useful when you wish to filter reports based on attributes that are not part of your forecasting hierarchy. In this exercise we will display custom Pareto codes that were defined as a custom filter in the secondary file.

Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 5*.

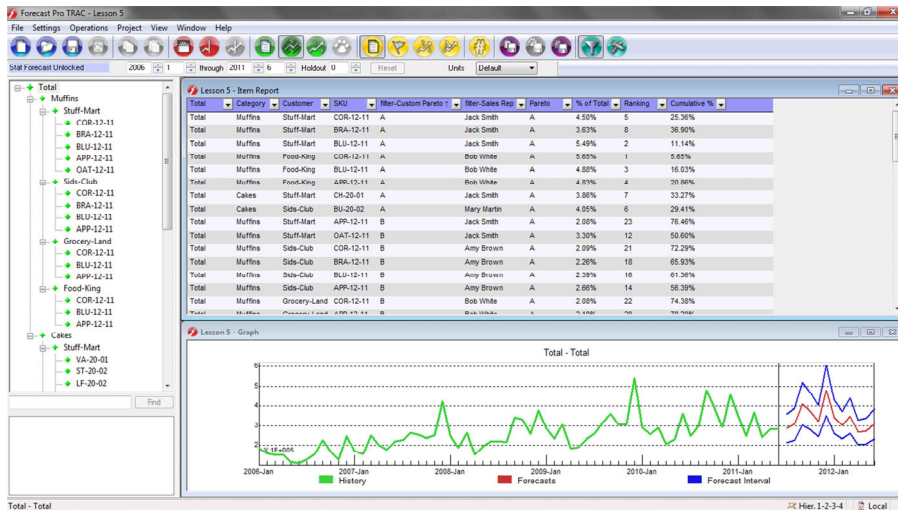
Right click on the Item Report view to display its context menu and select **Item Report Design**.



Open the *Select filter attributes to display* dropdown. Notice that there are two custom filters available—filter-Custom Pareto and filter-Sales Rep. Click the checkboxes for both custom filters and click OK.

Notice that the Item report now includes the two filter fields.

Click the light blue Filter icon to activate the filtering and sorting mode. Click on the filter dropdown for filter-Custom Pareto, select Sort A to Z and click OK. Your screen should now look like the one below.



Scroll through the report. Notice that the custom filter defined codes for A, B, C, D and E rather than just ABC. Using a custom filter for your Pareto codes allows you to specify as many categories as you wish, and assign membership in any fashion you desire.

Experiment with the filtering and sorting options until you are comfortable with their operation. When you are finished, exit the program without saving changes to the *Lesson 5* project.

This concludes Lesson 5.

Lesson 6

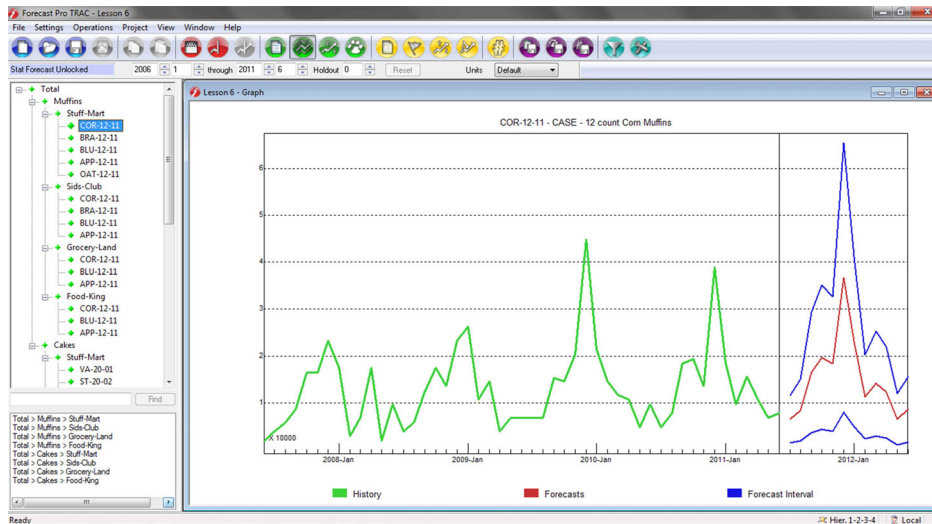
Tracking Forecast Accuracy

When you save a forecast project, Forecast Pro TRAC stores both the statistical forecasts and the final (i.e., adjusted) forecasts in the project's database. This means that if you have been updating your project and forecasts every planning period (for example, every month), that in addition to the current month's forecast, your project's database will contain forecasts that were generated in previous months. This record of previously generated forecasts is referred to as a *forecast archive*.

Maintaining a forecast archive allows you to track your forecast accuracy by comparing the forecasts that you generated previously to what actually happened. In this lesson we will explore Forecast Pro TRAC's tracking report and tracking graph views which are the primary vehicles for making this comparison.

Reading the Tracking Report

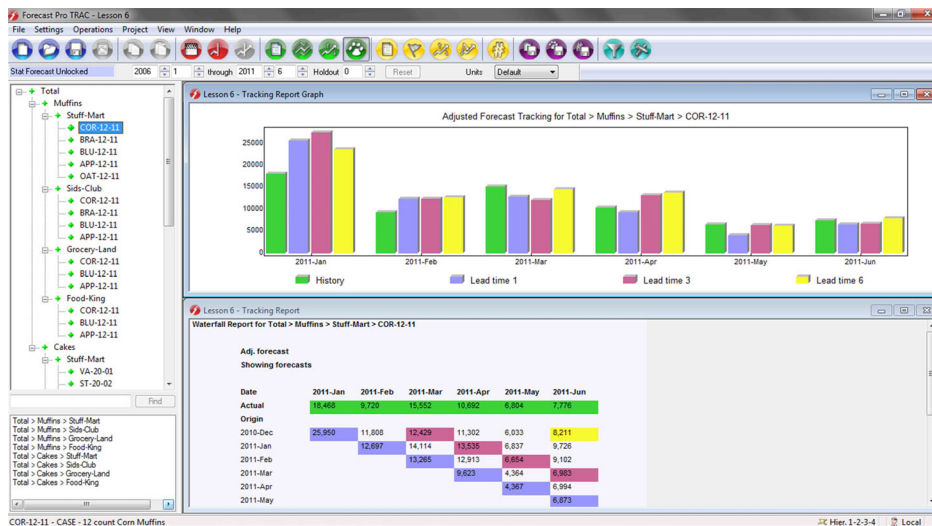
Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 6*. This project contains forecasts for the muffins and cakes data that we worked with in previous lessons.



Notice that for the current forecast period, the historic data begins in January 2006 and ends in June 2011, and that the first forecast period is July 2011. Forecast Pro TRAC refers to the most recent historic data period used to generate a forecast as the *forecast origin*. Thus, for the current forecast, the forecast origin is June 2011.

In addition to the current period's forecast, this forecast project contains archived forecasts for the last 12 months.

Turn off the Graph view. Click on the green View Tracking Report and Graph icon (🐾) to open the tracking report and tracking graph. Your display should now look like the one below.



Due to its cascading-like appearance, the tracking report is sometimes referred to as a *waterfall* report. The report compares what we forecasted to what actually happened, therefore it is based on two key elements—the actual demand history and archived forecasts for the periods being analyzed.

The actual demand history for the most current six months is shown in the first row with the green shading. The next 6 rows display the forecasts generated for these periods from different forecast origins. Thus, the row labeled 2010-Dec displays the forecasts generated six months ago when the forecast origin was December 2010 and the first forecast period was January 2011. The row labeled 2011-May displays the forecast generated last month when the forecast origin was May 2011 and the first forecast period was June 2011.

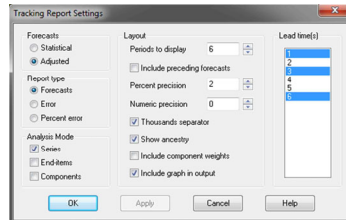
The waterfall report allows you to highlight different *lead* times. A lead time refers to the number of periods ahead of the forecast origin the forecast was made for. Thus, a one-month-ahead forecast would have lead time equals 1, a two-month-ahead forecast would have lead time equals 2, etc.

Notice that the forecasts for lead time equals 1 are all shaded in blue, the forecasts for lead time equals 3 are all shaded in maroon, the forecasts for lead time equals 6 are all shaded in yellow and that the same color coding is used on the tracking report graph. You can control the lead times to color code using the Tracking Report Settings dialog box.

The bottom portion of the report displays cumulative statistics for different *lead times*.

Customizing the Tracking Report

Right click on the tracking report to invoke the context menu and select **Tracking Report Settings**.



Notice that you can choose to view either the statistical or adjusted forecasts. This allows you to determine if your adjustments are adding value. You can also opt to view the forecasts themselves or the errors or the percent errors.

Select “Percent error” and click the Apply button. Notice that the display is updated accordingly. Click the “Include preceding forecasts” option and click Apply. This will display all archived forecasts that go into the cumulative statistics rather than just the subset in the triangular display.

The Analysis Mode setting controls what cumulative statistics to display for group-level data. The “Periods to display” controls the number of lead times to include in the report and the Lead time(s) box allows you to specify up to four lead times to color code.

Experiment with the report settings until you are comfortable with their operation. When you are finished, exit the program without saving changes to the *Lesson 6* project.

When reviewing tracking reports, you’ll often want to concentrate on items where the forecast accuracy has fallen outside of an acceptable range. Exception reports can be quite useful in this regard and is the subject of our next lesson.

This concludes Lesson 6.

Lesson 7

Exception Reporting

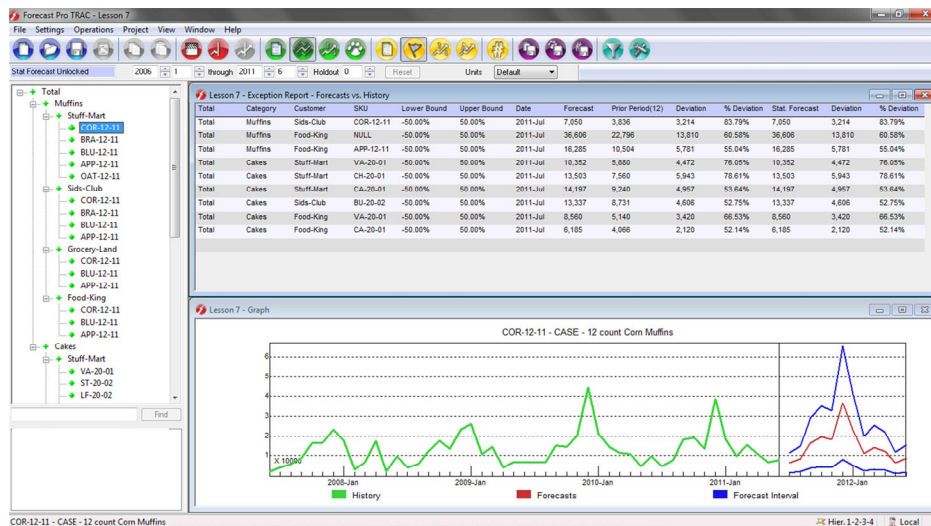
Exception reports enable you to quickly find cases where your forecast error or some other performance metric has fallen outside of an acceptable range. Exception reporting reduces the need for manual review of your forecasts, and allows you to focus on the items where human attention is most needed.

Forecast Pro TRAC provides a wide array of exception reports, some of which monitor the current forecasts and others which monitor your archived forecasts.

Monitoring Current Forecasts

Start Forecast Pro TRAC, select **File>Open** and open the project, *Lesson 7*. This project contains forecasts for the muffins and cakes data that we worked with in previous lessons.

Click the yellow View Exception Report icon () to open the Exception Report window. Your display should now match the one below.

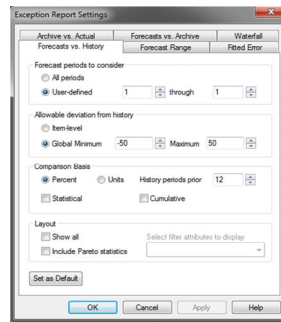


Notice that the window is labeled “Forecasts vs. History”. This report is comparing the July forecast to the historic value for the previous July and is flagging any cases where the change is greater than 50%.

The first four columns of the report identify the flagged item. The next two (Lower Bound and Upper Bound) display the thresholds that trigger an exception. The Date column identifies the exception period. The next two columns (Forecast and Prior Period(12)) display the item being monitored (in this case the forecast) and what it is being monitored against. The Deviation column shows the difference and the % Deviation column shows the difference as a percentage. The final three columns display the Statistical Forecast (which in this example equals the final forecast) along with the Deviation and % Deviation.

Point to the first item on the report and double click. Point to a different item on the report and double click. Notice that when you double click an item on the exception report, the Navigator jumps directly to that item. Thus, you can use the exception report as the equivalent of a Hot List to navigate through the listed items. All of the global report views (yellow icon views) support this kind of navigation.

Right click on the exception report and select **Exception Report Settings**.



The Exception Report Settings dialog box allows you to specify the exception report you'd like to view and customize the report.

The *Forecast periods to consider* section allows you to set the number of forecast periods to monitor. The current setting ("1 through 1") will only monitor the first forecast period (i.e., July 2011). Select "All periods" and click the Apply button. Notice the updated report now displays exceptions found during all forecast periods.

The next section, *Allowable deviation from history*, allows you to set the sensitivity of the exception thresholds. Currently we are using global thresholds that will flag any deviation of more than 50%. Change the global thresholds to minus 25 and plus 25, and click the apply button. Notice that the updated report reflects the new thresholds.

In addition to the global thresholds, Forecast Pro TRAC allows you to use item-level thresholds so that you can assign different sensitivities to different items. The item-level thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual.

The next section of the display, *Comparison Basis*, allows you to set whether you want the thresholds to use percentages or units, to set which historic point to compare the forecast with, to base the comparison on either the final forecast (which potentially includes user adjustments) or the statistical forecast and to use either individual forecast points or the cumulative total for the specified range. Our current settings which include a "History periods prior" setting of 12, will compare the forecast with the historic period 12 months prior (i.e., the same period last year).

The last section of the display, *Layout*, allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined).

Select the Forecast Range tab and click Apply. This report compares the forecast to defined upper and lower bounds and flags any forecasts that fall outside of the defined range. Notice that we are currently using Item-level thresholds—this is very common with the Forecast Range report.

Select the Fitted Error tab and click Apply. This report will flag as an exception any forecast model where the within-sample MAPE or MAD exceeds the current threshold.

Select the Forecasts vs. Archive tab and click Apply. This report compares the current forecast to an archived forecast for the same period and flags any cases where the change exceeds the thresholds. Our current example is monitoring the current July and August forecasts (“Forecast periods to consider” is set to “1 through 2”) against the forecasts we generated for July and August in the prior forecasting period (“Archive period” is set to one).

Monitoring Archived Forecasts

The final two exception reports monitor your archived forecasts rather than your current period’s forecast.

Select the Archive vs. Actual tab and click Apply. This report compares an archived forecast (i.e., a forecast you prepared in the past) to what actually happened. The “Periods to monitor” setting, in the “Historical periods to consider” section, controls how many historic periods to monitor. Our current setting of one will only monitor the most recent historic data point (June 2009 in our example). The “Lead time” and “Archive period” settings are only relevant if you are monitoring more than one historic point. They allow you to compare each historic point being monitored to either the corresponding forecast for a specific lead time or to forecasts made at a specific archive period (i.e., forecast origin).

Select the Waterfall tab and click Apply. This report compares the cumulative statistics for the specified lead time from the current waterfall report to the specified thresholds.

Experiment with the exception reports until you are comfortable with their operation. When you are finished, exit the program without saving changes to the *Lesson 7* project.

This concludes Lesson 7.

Lesson 8

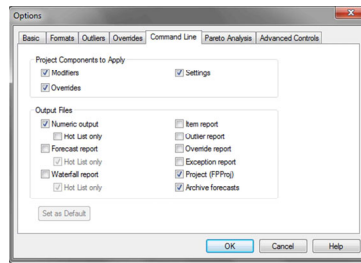
Operating From the Command Line

When the command line to execute the program includes a project file (FPProj) and the \b parameter, Forecast Pro TRAC will read the project, create the forecasts, save all output files and then exit. This feature is particularly useful when you are integrating forecasting with other software systems and desire a “hands-off” approach.

Command-Line Operation

In this lesson we will first use Forecast Pro TRAC interactively to create a project file. We will then exit the program and execute the script via the command line.

Start Forecast Pro TRAC and select **Settings>Options**. Set the data mode to Xls, the forecast horizon to 12 and then click on the Command Line tab.



The *Project Components to Apply* section allows you to control how the forecasts are generated when the project is run from the command line.

If *Modifiers* is selected, the project's forecast modifiers (if any are present) will be used to generate the forecasts in command-line mode. If this option is not selected, all forecast modifiers in the project will be ignored when running from the command line.

If *Overrides* is selected, the command-line run will begin by reading in the data, generating the statistical forecasts and then it will apply any matching overrides/comments in the project to the new forecasts. If this option is not selected, all overrides in the project will be ignored when running from the command line.

If *Settings* is selected, the command-line run will use all of the settings associated with the project (e.g., all settings in the Settings dialog box, numeric output formatting, etc.). If this option is not selected, the default settings (i.e., the settings that have been saved as the defaults for use with new projects) will be used when running from the command line.

The *Output Files* section allows you to specify the output files to generate when the project is run from the command line. The format and content of these files will match the current project's settings.

Make sure your settings match the ones above. Click the OK button to save your selections.

Click the red Script icon and define a script consisting of the single line

123 Bakery

Click OK to accept the script and then select **File>Save** to save the project. Name the project “Test”. Exit Forecast Pro TRAC.

We will now run the project from the command line.

Select **Run** from the Windows Start Menu. Execute the program including Test.FPProj as a parameter followed by “ /b”. If you installed Forecast Pro TRAC into a directory named “C:\Program Files\Forecast Pro TRAC v2” the command line should read (including the quotation marks):

```
"C:\Program Files\Forecast Pro TRAC v2\ForecastProTRAC.exe" Test.FPProj /b
```

After issuing the command, the program will execute the script and create all of the requested output files. Examine your output directory to confirm the files were created.

For more detailed information regarding command-line operation consult the Reference section of this manual.

This concludes Lesson 8.



3

TUTORIAL: Forecasting Operations

Lesson 9

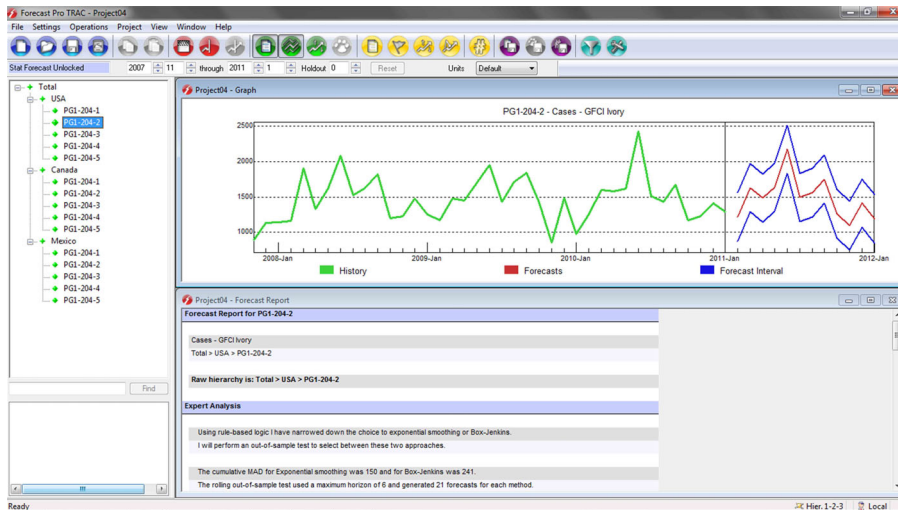
Using Forecast Modifiers

In the very first lesson you prepared forecasts using expert selection—Forecast Pro TRAC’s default model selection procedure. In this lesson you will use forecast modifiers to dictate the forecasting models to be used for specific items.

Specifying Forecast Modifiers for Individual Items

Start up the program and click the red Script icon () to call up the Define Script dialog box. Double click on *ACME Hardware* to place it on the first line of the script. Click OK to accept the script. Click the red Read Data icon () to read in the data and then the red Forecast icon () to generate the forecasts.

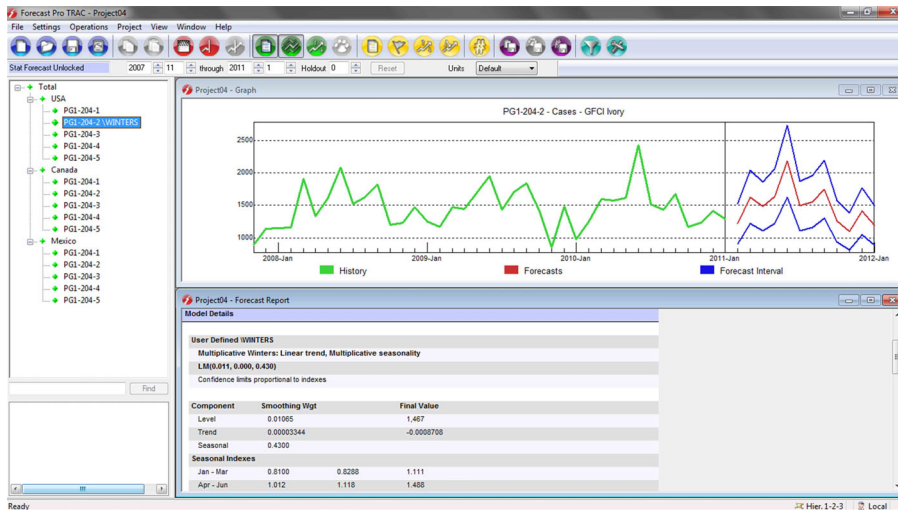
Fully expand the Navigator using the **Expand All** option on its context menu and open the Graph view by clicking its green icon (). Select *Total>USA>PG1-204-2*. Your display should now match the one shown below.



If you do not instruct Forecast Pro TRAC to use a specific forecasting technique it will use expert selection to select the appropriate technique for each item forecasted. If you examine *Total>USA>PG1-204-2*'s forecast report you'll notice that it includes an Expert Analysis section and that expert selection chose to forecast this item using a nontrended, seasonal exponential smoothing model.

Let's say that we wish to dictate that a Winters exponential smoothing model be used for this item. Winters is a form of exponential smoothing which includes both a trend and seasonal component.

To specify the model, right click on *Total>USA>PG1-204-2* to bring up the Navigator's context menu and then select **Model>Exponential Smoothing>Winters**.



Notice that \WINTERS now appears next to *Total>USA>PG1-204-2* on the Navigator. \WINTERS is a forecast modifier. In this instance it is used to indicate that you have opted to use a Winters exponential smoothing model for this item rather than expert selection.

Examine the forecast report to verify that the Winters model was used. You'll notice that the Expert Analysis section is no longer present and that the Model Details section indicates that a "User Defined \WINTERS" model was built.

Select *Total>USA>PG1-204-4* on the Navigator. Right click to call up the context menu and select **Model>Very Simple Models>Same as Last Year>Plus Percent**. Specify the percentage as "10" and click OK.

Notice that \SALYP=10 now appears next to *Total>USA>PG1-204-4* on the Navigator. This model will set the forecasts to equal the same values as the preceding year plus 10%.

Specifying Forecast Modifiers for Multiple Items

Select the group *Total>Canada* on the Navigator. Right click to call up the context menu and select **Model>Box-Jenkins>Auto**. Notice that \BJ now appears to the right of the group *Total>Canada*.

Let's say that we wish to dictate that a Box-Jenkins model be used for every item in the group Canada. To accomplish this, select **Apply Modifier(s) To>Children** on the Navigator's context menu. Notice that the \BJ modifier now appears on all of *Total>Canada's* "children" (i.e., all items one level down in the group *Total>Canada*).

Specifying Custom Forecast Modifiers

In addition to the commonly used forecasting models found on the Model context menu, Forecast Pro TRAC supports a broad range of custom modeling modifiers. These modifiers accommodate a wide range of modeling options including confidence limits percentiles, safety stock lead times and power transformations.

Custom modifiers are entered using the **Custom Modifier** option on the Navigator's context menu.

Consult the *Using Forecast Modifiers* section to see a full list of the available modifiers. The modifiers are also documented in the help system.

Experiment with the various modeling options until you are comfortable with their operation. When you are finished, exit the program.

This concludes Lesson 9.

Lesson 10

Building Event Models

Event adjustment models extend exponential smoothing by allowing you to adjust for events like sales promotions, strikes or simply for unexplained outliers. You can adjust for events of several different types. These could be promotions of different types or sizes, or different calendar effects like Easter and Independence Day weeks. Forecast Pro TRAC knows these occurrences simply as events of types 1, 2, etc.

Event adjustment models work almost the same as seasonal index models. In a seasonal index model, each month gets its own index, which is updated each time that month recurs. In an event adjustment model, each event type gets *its* own index, which is updated each time an event of that particular type recurs. The difference is that while January recurs every 12 months, an event of type 1 usually recurs irregularly.

Since Forecast Pro TRAC knows that January occurs every 12 months, you don't have to provide that information. To implement event adjustment, however, you must tell the program when events of each type occur. To do this, you must construct an event variable which classifies each period by event type (0=no event, 1=event of type 1, 2=event of type 2, etc.). The format is the same as that for any other historic data record, except that its variable name must begin or end with an underscore (_) and its data entries must all be integers. The event variable must be defined for each period in the

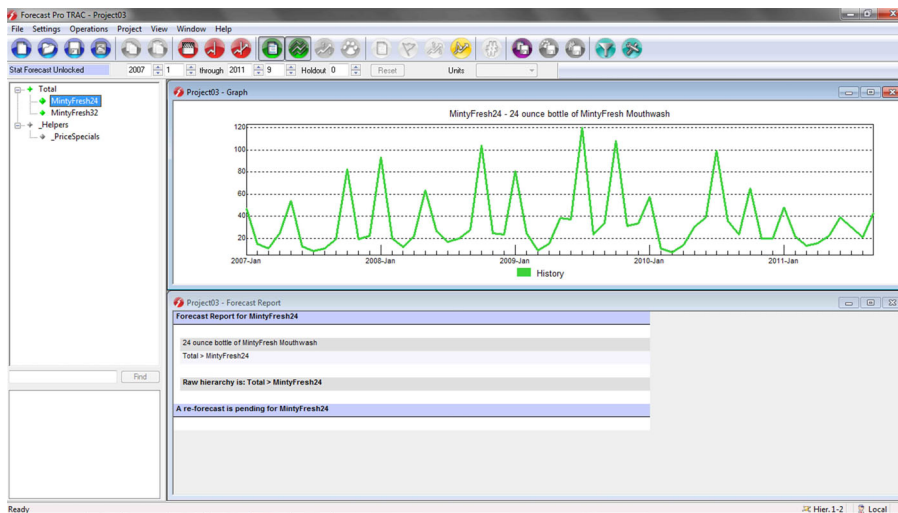
historic record. If you want to forecast the effects of future known events, you must include these future periods as well.

For more statistical details, please consult the statistical reference for exponential smoothing in the *Forecast Pro Statistical Reference Manual*.

In this lesson you will use an event model to capture the relationship between sales of mouthwash and promotions. You will also use an event model to capture seasonal patterns in weekly data.

Modeling Promotions

Click the red Script icon (📄) and create a script listing *Minty Fresh Mouthwash* on the first line. Click OK to accept the script, then click the red Read Data icon (📡) to read in the data and, finally, click the green View Graph icon (📈) and use the Navigator to display a graph of MintyFresh24.

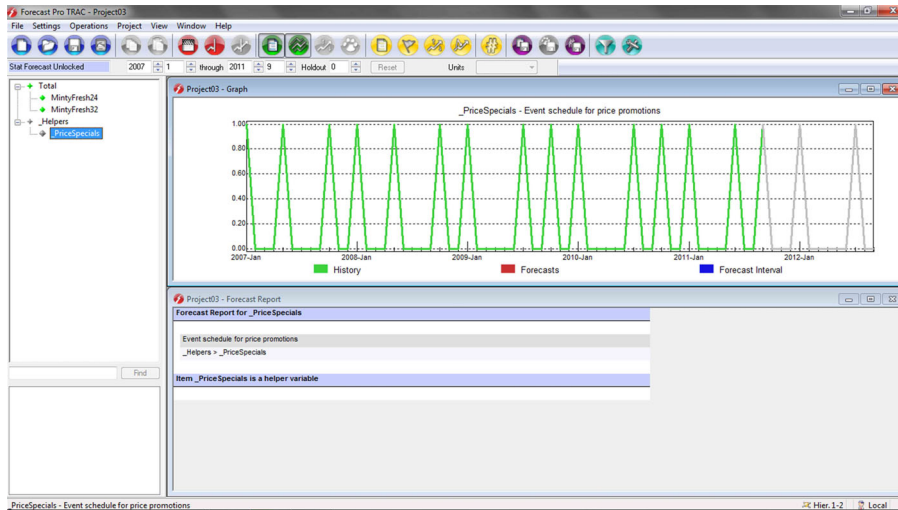


MintyFresh24 represents monthly sales of a nationally advertised brand of mouthwash in a certain size package. The prominent peaks on the graph are not due to seasonal patterns—they are the result of price promotions. Select MintyFresh32 on the Navigator. This series represents sales of the same product in a different size package. “_PriceSpecials” is an event variable—we will discuss this variable shortly.

Let's begin by modeling MintyFresh24 and MintyFresh32 using expert selection. Click the red Forecast icon (🔴). When the calculations are complete, view the forecast report for MintyFresh24. Notice that a nontrended additive seasonality exponential smoothing is selected and that the adjusted R-square is 0.50. Exponential smoothing recognized the effects of the promotions as a form of irregular seasonality. The forecasts from such a model tend to repeat the promotional pattern of the last year of historic data. If, as is usually the case, your future promotions are patterned differently, the forecasts may be very bad.

Include the fitted values on the graph. (This is accomplished by toggling on *Fitted* on the graph's context menu). Notice that the model predicted several peaks that did not occur as well as missing several that did. The model is trying to capture the peaks as part of the seasonal pattern. However, the promotions that caused these peaks did not always fall in the same months and thus cannot be modeled using a seasonal model.

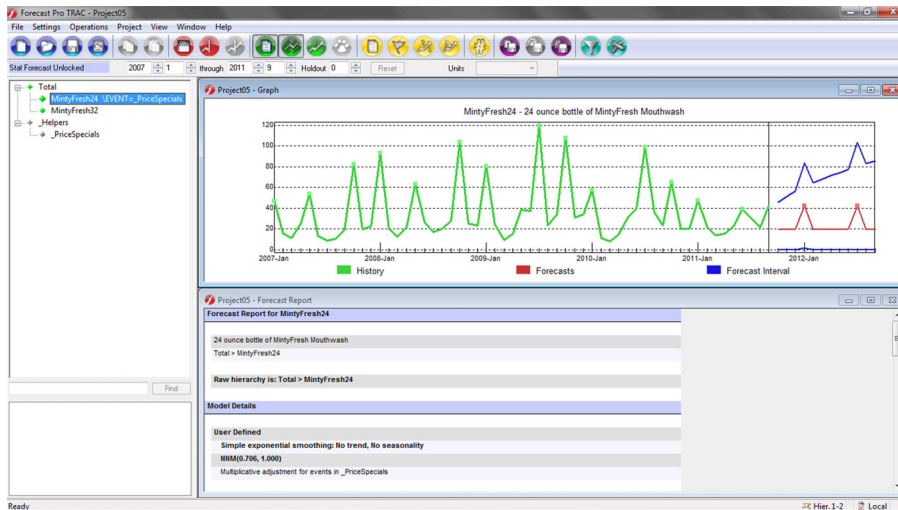
Select `_PriceSpecials` on the Navigator.



`_PriceSpecials` is an event variable. `_PriceSpecials` takes the value of zero when MintyFresh24 and MintyFresh32 are not promoted and the value of one when they are. Notice that the series includes the promotional schedule for the forecast period. When you use `_PriceSpecials` to build an event model an adjustment will be included for the promoted months (any variable whose

name begins or ends with an underbar is recognized as a “helper” variable and will not be forecasted).

PriceSpecials reflects the simplest type of event variable. Each month is coded either as promoted (1) or not promoted (0). At times you may have more than one type of event. For example, imagine that you had both price promotions and rebate promotions. In this case you would create an event file coding months as not promoted (0), price promoted (1) or rebate promoted (2). When you build the event model it will include two different adjustments, one for price promoted months (type 1 months) and one for rebate promoted months (type 2 months).



Select MintyFresh24 on the Navigator. Right click to call up the context menu and select **Events**. Selecting **Events** will display the available helper variables and allow you to select the one you wish to use. In this example there is only one helper variable, PriceSpecials. Select PriceSpecials to build the event model.

Examine the forecast report for MintyFresh24. Notice that an exponential smoothing model was used and that the model includes an event smoothing weight. In addition, notice that the adjusted R-square is now 0.79.

The graph the results reveals a much better fit to the data and forecast peaks that correspond to the months indicated as promoted rather than the “seasonal” pattern.

Select **Apply Modifier(s) to** on the Navigator's context menu and select **All Items**. This will specify that the event model should be built for every item on the Navigator. In this example, this is appropriate since the same promotional schedule was used for both MintyFresh24 and MintyFresh32.

If the two products had been promoted differently we would have created two separate event variables.

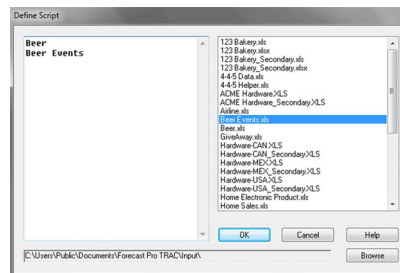
Business Forecast Systems has conducted extensive out of sample testing on event adjustment models. This research demonstrates that event adjustment models nearly always yield a substantial real world benefit in forecast accuracy.

Modeling Weekly Data

Select **File>New**. The program will ask you if you wish to save changes to the current project—click No. Click **Settings>Options**, set the forecast horizon to 52 and click OK. In this exercise we will model weekly beer sales for a brand of beer in various types of packages.

Create a script containing the two lines

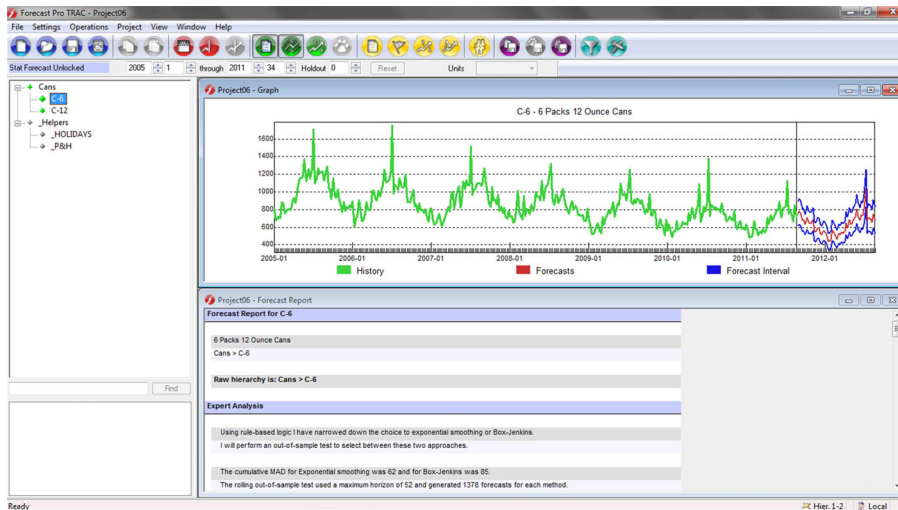
```
Beer  
Beer Events
```



In the last example, our event schedules were included directly in our data file. In this example, we've elected to put the event variables in a separate file named *Beer Events*. Maintaining your event schedules and/or weighting variables (discussed in Lesson 11) in a separate file from the historic data is often convenient. For instance, if your IT department generates the historic data files for you each forecast period, keeping the event schedules in a

separate file allows you to edit and maintain them without the assistance of the IT department.

Read in the data, create the forecasts, expand the Navigator and graph C-6. C-6 represents sales of beer in cans packaged in 6-packs.



In order to get a better view of the data, turn off the Forecast Report window. Right click the Graph view to invoke its context menu and select **Graph Settings**. Open the Components tab, remove the checkmark for “All”, set “Periods” to 156 and click OK. Note that the display is now scrollable. *Periods* allows you to select how many data points will be shown on-screen when the *All* option is not selected.

Add the fitted values to the graph using the graph’s context menu.

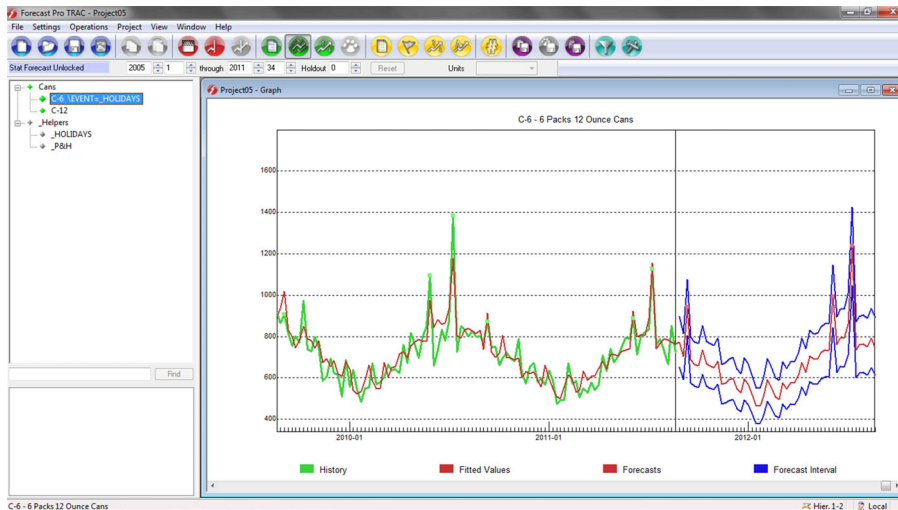


One noticeable feature of this data set is that sales for the weeks containing the three US summer holidays (Memorial Day, 4th of July, Labor Day) are higher than other weeks. If you look closely at the data you'll notice that these holidays sometimes change weeks, and when this occurs, the fit can be poor. For instance the 4th of July fell in week 27 before 2008, but fell in week 28 in 2008 and thereafter. The fitted value for week 27 in 2008 exhibits a strong peak and "misses" the actual holiday peak that fell in week 28.

Forecast Pro TRAC used a standard Winters model to forecast C-6. This model uses 52 seasonal indexes for the data and does not accommodate the holidays changing weeks from year to year.

Graph the event variable `_Holidays`. `_Holidays` takes on the value of "1" for the week containing Memorial Day, the value of "2" for the week containing the 4th of July, the value of "3" for the week containing Labor Day and "0" for all other weeks. Including an event index for each holiday allows us to model the holidays that move around the calendar. (If we were to model this data as a monthly series, the holidays would not change periods and an event model would not be necessary.)

Build the model by clicking C-6 on the Navigator and using the context menu to add the event variable `_Holidays`.



The model now includes 52 seasonal indexes to capture seasonality and three event indexes to capture the summer holidays. Examine the fit to the holiday weeks and notice that the event model is not “missing” the holidays when they move around the calendar.

Although we would like the seasonal indexes to capture a smooth seasonal pattern in this case they do not. This is because of the low level of temporal aggregation and other problems peculiar to weekly data:

The year usually begins and ends with a partial week.

Holidays such as Easter and Independence Day do not occur in the same week each year.

Some years may contain 53 weeks, depending upon how a week is defined. Different corporations address this differently.

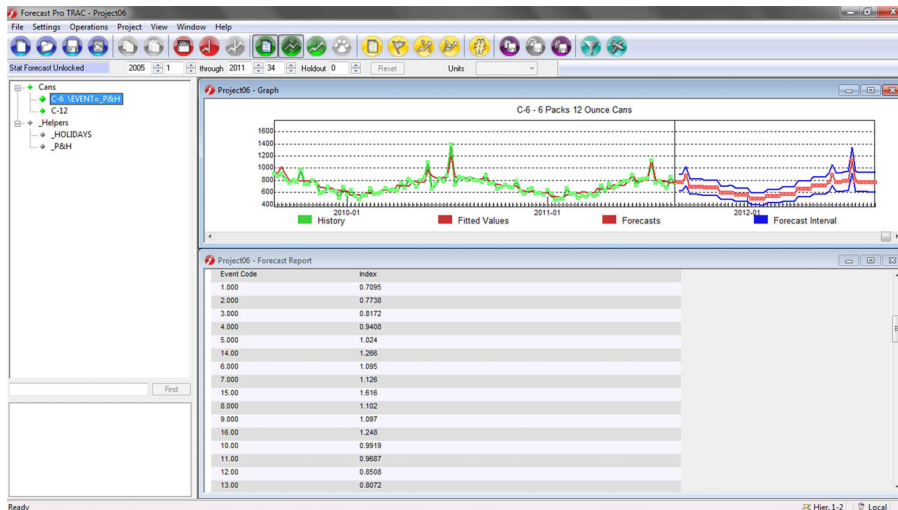
Generally speaking, monthly models will more accurately capture seasonality. Nevertheless, many corporations *must* deal with weekly seasonal data because production and inventory control require it. Event adjustment models can help you with some of the problems that you will face.

Event models allow you to control how many indexes to include in the model. To illustrate, let's model C-6 using the _P&H event variable.

_P&H maps each week into one of 13 periods (i.e. weeks 1-4 are coded 1, weeks 5-8 are coded 2, etc.). The summer holiday weeks (Memorial Day, 4th of July and Labor Day) are coded as 14, 15 and 16 respectively. You may want to examine the data in the *Beer Events.xls* spreadsheet to see precisely how this is accomplished.

Turn back on the Forecast Report view and then use the Navigator's context menu to specify that _P&H be used as the event schedule for C-6.

The resulting model uses 16 event indexes—13 to capture the seasonality and three for the summer holidays.



Notice that the forecasts exhibit much smoother seasonality than our previous model. That is because there are now more samples of each index to be estimated.

Adjustment for Outliers

Historic data sets often exhibit the effects of one-time events that cause outliers. The event that causes the outlier may be known or unknown. Although exponential smoothing is a remarkably robust procedure, these outliers may decrease the quality of the forecasts and (especially) the confidence limits.

You can eliminate the effect of an outlier by coding it as a special event that occurs only once. If you have several outliers, each must be coded as a distinct event type. Forecast Pro TRAC will “explain” each outlier as the result of its associated event.

The impact of outliers on the forecasts and the confidence limits will be greatly reduced. Beware however: if outliers continue to occur in the forecast period, then the confidence limits are likely to be unrealistically narrow.

More Adjustments for Promotions

The event adjustment model provides a very flexible framework to treat promotional effects of many kinds. This section briefly notes some of them. Its purpose is to indicate some directions you may want to take with your own business data.

The examples that are given require coding additional event types in your event variable. Each new event type provides additional ability for Forecast Pro TRAC to explain your historic data by making the event variable more complex. Keep in mind that if your event description is overly complex, the out-of-sample performance of your model may deteriorate. You must strike the right trade-off between goodness-of-fit to your historic data and model complexity. To do this will require experimentation and monitoring of actual model performance.

Example 1. A promotion in (say) September may have effects in August and October as well. Buyers may delay purchases in August and they may be overstocked in October. You can code the pre- and post-promotional effects as event types of their own. These events will, of course, be associated with *decreases* in sales.

Example 2. Sometimes one SKU of a brand or product line is promoted but closely related SKU's are not. The result may be that the promoted SKU cannibalizes the sales of the other SKUs. You can treat this effect by coding cannibalization events for these SKUs. But be cautious. Overuse of this technique will result in an overly complex model and possible deterioration of forecast performance.

This concludes Lesson 10.

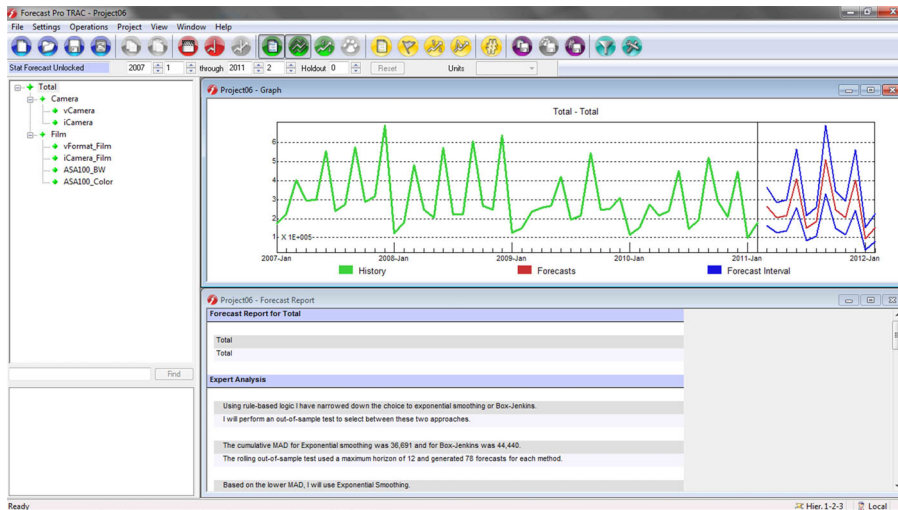
Lesson 11

Building Multiple-Level Models

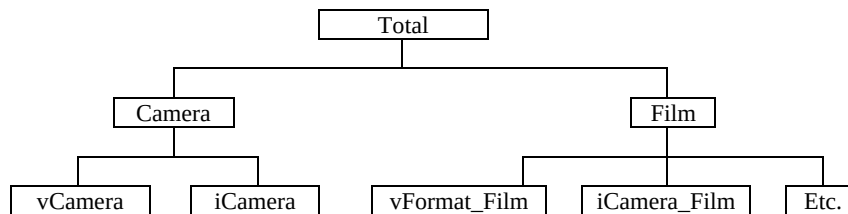
In this lesson, you will learn how to define group variables and prepare multiple-level forecasts.

Bottom-up and Top-down Forecasting

Start the program, click the red Script icon and select *Presto Camera Company*. Accept the script, read in the data, forecast the data, open the graph view and fully expand the Navigator. Your screen should now look like the one shown below.



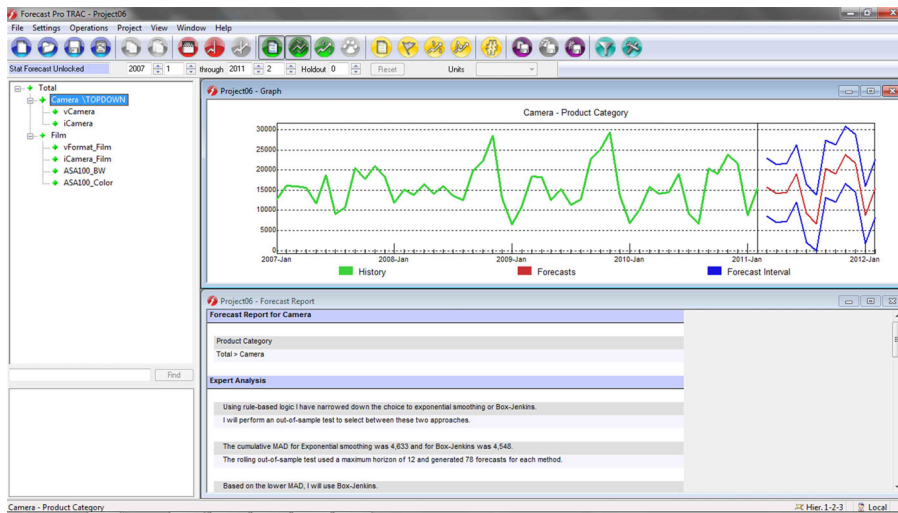
Notice that the Navigator tree structure matches the hierarchy shown below.



The tree contains three *group* variables (Total, Camera and Film). The tree also contains six end items (vCamera, iCamera, vFormat_Film, iCamera_Film, ASA100_BW and ASA100_Color). The demand histories for group variables are not in the database. They are created by Forecast Pro TRAC by aggregating the appropriate end items. Thus, the history for the group Camera is defined as the sum of vCamera + iCamera. The history for the group Film is defined as the sum of vFormat_Film + iCamera_Film + ASA100_BW + ASA100_Color. The history for the group “Total” is defined as the sum of the groups Camera + Film.

When you forecast a multiple-level hierarchy Forecast Pro TRAC will automatically reconcile the forecasts. By default a bottom-up reconciliation will be performed (this is the case in our current example). That means that the group-level forecasts will be generated by aggregating their component forecasts. For example, the forecast for the group Camera would be made by summing the forecasts of vCamera and iCamera.

An alternative is to use top-down reconciliation. Select *Total > Camera* on the Navigator and right click to display the Navigator's context menu. Select Top down. Notice that the \TOPDOWN modifier now appears next to Camera.



The \TOPDOWN group modifier instructs the program to adjust lower-level forecasts to sum up to the indicated level. Let's illustrate how this works by considering the various steps involved in forecasting our current example.

Step One: Prepare forecasts at all levels (i.e., prepare forecasts for “Total”, Camera, Film, vCamera, iCamera, vFormat_Film, iCamera_Film, ASA100_BW and ASA100_Color based on their past history).

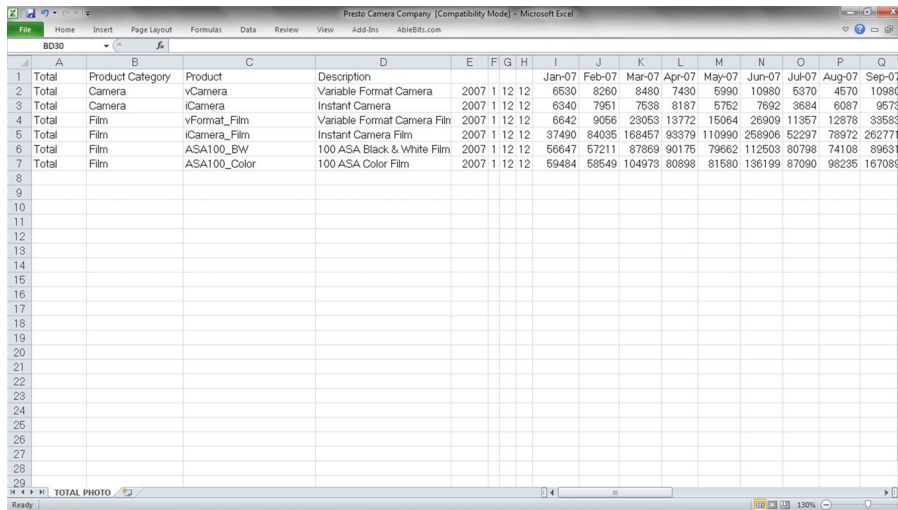
Step Two: Since the group Camera is being forecasted top down, the forecasts of vCamera and iCamera are adjusted proportionally so that they sum to the Camera forecast.

Step Three: Since the group Film is being forecasted bottom up (the default) the Film forecast is replaced with the sum of the forecasts for vFormat_Film, iCamera_Film, ASA100_BW and ASA100_Color.

Step Four: Since the group “Total” is being forecasted bottom up (the default) the “Total” forecast is replaced with the sum of the forecasts for Film + Camera.

There is one other group modifier. \INDEXES instructs the program to estimate the seasonal indexes at the group level and use them for all members in the group. This is particularly useful when some members of the group have short histories or small demand and seasonal factors are thus difficult to calculate.

Defining Groups Using Attribute Fields



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Total	Product Category	Product	Description	2007	1	12	12	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
2	Total	Camera	vCamera	Variable Format Camera	2007	1	12	12	6530	8260	8480	7430	5990	10980	5370	4570	10980
3	Total	Camera	iCamera	Instant Camera	2007	1	12	12	6340	7951	7538	8187	5752	7692	3684	6087	9573
4	Total	Film	vFormat_Film	Variable Format Camera Film	2007	1	12	12	6642	9056	23053	13772	15064	26909	11357	12878	33583
5	Total	Film	iCamera_Film	Instant Camera Film	2007	1	12	12	37490	84035	168457	93379	110990	258906	52297	78972	262771
6	Total	Film	ASA100_BW	100 ASA Black & White Film	2007	1	12	12	56647	57211	87869	90175	79662	112503	80798	74108	89631
7	Total	Film	ASA100_Color	100 ASA Color Film	2007	1	12	12	59484	58549	104973	80898	81580	136199	87090	98235	167085

The spreadsheet *Presto Camera Company.xls* is shown above.

In this example, we defined the groups Total, Camera and Film directly in the spreadsheet using attribute fields (columns A and B).

If we had included additional attribute fields we would have created a larger hierarchy. Consult the *Setting Up Your Data* section of this manual for complete details.

Combining Multiple Level and Event Adjustment Models

In many cases, the SKU's or product lines in a multiple-level hierarchy are subject to promotional effects. You can use the event model methodology described in Lesson 5 to account for such effects.

Example 1. A product line, consisting of aggregated SKU's is promoted as a unit. You believe that all the SKU's in the product line will be affected similarly. You can deal with this by using the following approach.

```
LINE \EVENT=_PROMO \TOPDOWN
    SKU1
    SKU2
    SKU3
```

This causes Forecast Pro TRAC to execute the following procedure.

Forecast the group LINE, taking promotions into account.

Forecast the SKU's *without* taking promotions into account.

Adjust the SKU forecasts so that they sum to the LINE forecasts. This propagates the group level promotional effects to the SKU's.

Example 2. Now suppose that only one SKU of the group is promoted. The following approach can account for this promotion.

```
LINE
    SKU1 \EVENT=_PROMO
    SKU2
    SKU3
```

This causes Forecast Pro TRAC to forecast the SKU's individually. It then sums these forecasts to obtain forecasts for the group LINE.

What if you were to add the keyword \TOPDOWN to the group LINE in this example? The effect would be that the promotion of SKU1 affects it but does not affect overall sales at the group level. This might be the case if the

promotion affected sales only by cannibalizing other SKU's in the group. This is a dubious effect. It is usually better to prepare forecasts bottom-up when there are distinct models for the lower-level units.

Short-Lived Products

A manufacturer often maintains a product line for a long period of time but frequently changes the SKU's that make up the line. A laser printer manufacturer, for instance, often introduces new models and retires old ones. The result may be that the overall product line can be accurately forecasted, but the individual item histories are too short to support seasonal models. In these instances the top-down approach is particularly useful.

For instance assume that SKU1 and SKU2 have been phased out and replaced by SKU3 and SKU4. We also assume that at the end of the historic data, only SKU3 and SKU4 are alive. However, the histories for SKU3 and SKU4 are too short to generate seasonal forecasts. The manufacturer is interested in forecasting the group LINE, SKU3 and SKU4. The approach below takes care of the problem.

```
LINE \INDEXES
      SKU1
      SKU2
      SKU3
      SKU4
```

This causes Forecast Pro TRAC to follow the following procedure.

Forecast LINE, obtaining seasonal indexes.

Use the LINE seasonal indexes to deseasonalize the SKU's.

Forecast the resulting nonseasonal SKU-level data. These nonseasonal models require very little data.

Use the LINE seasonal indexes to reseasonalize the SKU-level forecasts.

By default, the LINE forecasts are then replaced by the summed SKU-level forecasts. If you do not want this to happen, you can add the keyword \TOPDOWN to the group LINE.

The script presented in this example can also be used when the SKU-level histories are long lived. The result is that seasonality is accounted for at the LINE level. This is desirable when the SKU's are likely to have similar seasonal patterns, but the data are too irregular for accurate estimation of seasonal indexes at the SKU level.

This concludes Lesson 11.

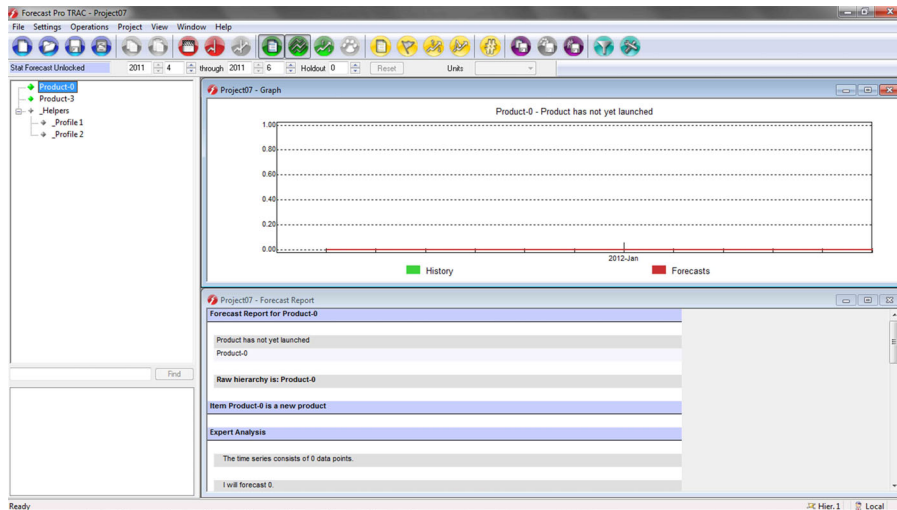
Lesson 12

New Product Forecasting

In this lesson, you will explore different approaches to forecasting new products. The lesson begins by examining some of the options available in Forecast Pro TRAC for generating forecasts prior to the product being launched (i.e., when historic data are not yet available). It then illustrates how to apply two forecasting methods designed specifically for forecasting new products—forecasting by analogy and the Bass model.

Working With No Data

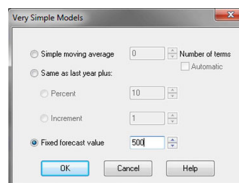
Start the program, click the red Script icon and select *New Product Data*. Accept the script, read in the data, forecast the data, open the graph view and fully expand the Navigator. Your screen should now look like the one shown below.



Notice that *Product-0* has no demand history. By default, Forecast Pro TRAC will generate a forecast of zero for a time series with no history. Notice also the confidence limits are set equal to the forecasts. The first forecast period is established by the script as a whole—in this example, July 2011.

One option is to use the override facility to enter the desired forecast in the form of an override.

Another option is to use the fixed forecast value model. This model allows you to set the statistical forecast to a specific value. Right click *Product-0* on the Navigator to invoke the context menu and then select **Model>Very Simple Models>Fixed Forecast Value**.



A dialog box will appear allowing you to specify the value. Set the value to 500 and click OK. Examine the Graph and Forecast Report views to verify that the forecast is now set to 500.

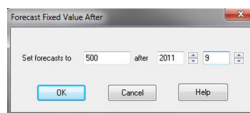
A related modeling option to Fixed Forecast Value is Fixed Value After. This option is used when you wish to set the statistical forecast to a specific value

after a specific point in time. This can be useful when you are discontinuing a product and wish to set the forecast to zero part way through the forecast horizon or for a new product that won't come on line until part way through the forecast horizon.

For our example, let's suppose that *Product-0* will not come on-line until October 2011. We'd therefore like the forecast to be zero until September 2011 and 500 units per month thereafter.

To accomplish this we must first remove the Fixed Forecast Value setting. Right click *Product-0* on the Navigator to invoke the context menu and then select **Remove Modifier(s)**. This will restore the default forecast of zero.

Right click *Product-0* on the Navigator to invoke the context menu and then select **Model>Very Simple Models>Fixed Value After**.



Enter 500 as the Set forecasts to value and set the after date to September 2011. Click OK and verify the forecast is now zero until September 2011 and 500 thereafter.

Exit Forecast Pro TRAC.

Forecasting by Analogy

In this exercise we'll create forecasts for a new product using a technique known as forecasting by analogy. This approach is sometimes also referred to as "looks like" analysis.

The concept is a very simple one. You are launching a new product and you expect the initial sales pattern to be similar to an analogous product's initial sales pattern or to a "launch profile" that you've created. To use this method, you must supply the launch profile or "analog series" in the form of a helper variable. Helper variables names *must* start or end with an underbar. Helper variables are used in conjunction with event models, by analogy models and weighting transformations.

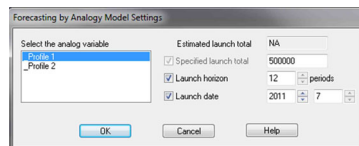
If the product has not yet launched (i.e., there is no historic data available) then you must also supply an estimate of the initial sales over a specific period of time (the “launch total” over the “launch horizon”). Forecast Pro TRAC will then create the forecast by proportionally allocating the launch total over the launch horizon using the analog series to define the proportions.

If any historic demand for the new product is available, you may either supply the launch total and launch horizon or allow Forecast Pro TRAC to calculate the forecasts by fitting the existing data to the analog series.

In this exercise, we will look at two examples—one where no data are available for the new product and the other where the initial 3 months of sales are known.

Start the program, click the red Script icon and select *New Product Data*. Accept the script, read in the data, forecast the data, open the graph view and fully expand the Navigator.

Right click *Product-0* on the Navigator to invoke the context menu and then select **Model>By Analogy**.

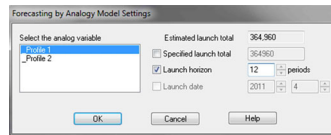


We must begin by selecting the analog variable to use. In our example there are two available. Select *_Profile 1* by clicking it. Since *Product-0* does not contain any historic demand, a launch total must be specified. The default value for the Specified launch total is to calculate it using the values specified in the analog variable—in our example this yields 279,587. Let’s say that our market research leads us to believe that this new product will sell 500,000 units in the first 12 months. To have our forecast reflect this assumption, edit the Specified launch total to equal 500000. Check the boxes for Launch horizon and Launch date. Notice that the default Launch horizon is set to 12 (the length of the data plus the forecast horizon) and that the default Launch date is July 2010 (the first forecast point). Click OK to build the model.

Examine the output. Notice that the forecast now reflects the shape of the analog variable.

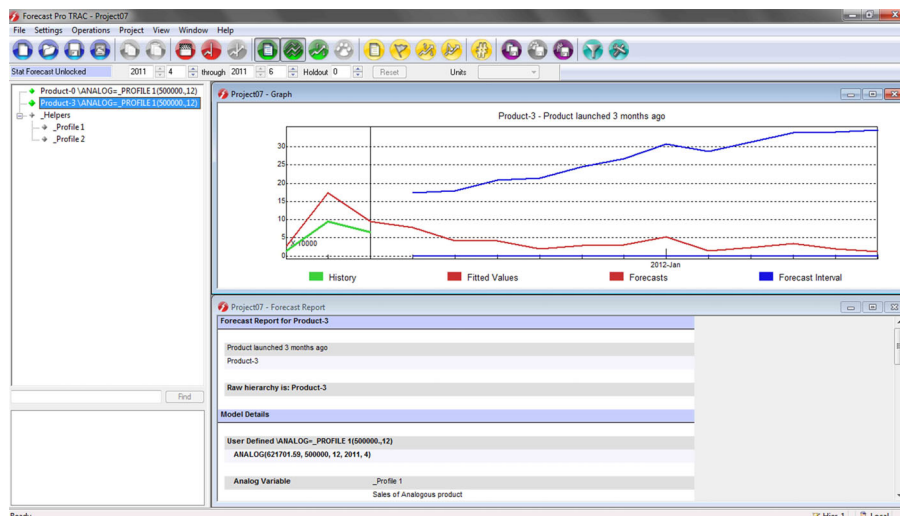
Now we will use the By Analogy method to prepare forecasts for the same product after we have 3 months worth of history.

Right click *Product-3* on the Navigator to invoke the context menu and then select **Model>By Analogy**. Select *_Profile 1* as the analog variable by clicking on it. Select Launch horizon and set the number of periods to 12. The dialog box should now look like the one below.



Now that we have some historic data, Forecast Pro TRAC is able to fit the Analog model and calculate the estimated launch total from the historic demand. The estimated launch total predicts that at our current rate, we will sell 364,960 units during the Launch horizon (the first 12 months in our example).

This is substantially less than the 500,000 units our market research predicted. Select Specified launch total and set it to 500000. Click OK to build the model. Right click on the Graph view to invoke its context menu. Add the fitted values to the graph by selecting Fitted.



The forecast shows the sales now required to achieve the specified launch total. The fit shows the historic volume that would normally be associated with the current forecast. The green line shows the actual sales to date—which in this example is substantially lower than the fit.

Right click *Product-3* on the Navigator to invoke the context menu and then select **Model>By Analogy** to return to the By Analogy dialog box. Remove the check mark from the Specified launch total option and click OK to build the model using the estimated launch total. Examine the results and then exit Forecast Pro TRAC.

This ability to compare your specified launch totals with the estimated launch totals is quite powerful and will often illustrate the need to revisit your assumptions as the actual demand comes in.

Using the Bass Model

In this exercise we'll create forecasts for a new product using the Bass diffusion model. The Bass model is most often used to forecast first time purchases of new-to-world products.

The model tries to capture the adoption rates of two types of users—innovators and imitators. Innovators are early adopters of new products and are driven by their desire to try new technology. Imitators are more wary of new technology—they tend to adopt only after receiving feedback from others.

The Bass model uses two coefficients to quantify the adoption rates. The *Coefficient of Innovation*, referred to in the literature as “p”, controls the rate for the innovators. The *Coefficient of Imitation*, referred to in the literature as “q” controls the rate for the imitators.

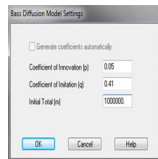
If you have 5 or more historic data points, these coefficients can be fit to the data. To build a Bass model with fewer than 5 data points you must set the values for these coefficients along with the total number of potential adopters.

In this exercise, we will look at two examples—one where no data are available for the new product and the other where the initial 6 years of adoptions are known.

Start the program, click the red Script icon and select *Home Electronic Product*. Accept the script, read in the data, forecast the data, open the graph view and fully expand the Navigator.

Right click *HE-No data* on the Navigator to invoke the context menu and then select **Model>Bass Diffusion**.

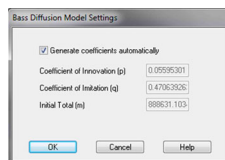
In this example we have no historic data so we will need to specify the Coefficient of Innovation, the Coefficient of Imitation and the Potential Market. The coefficients could be set using values from an analogous product's model. There is also a considerable body of literature on the Bass model including published coefficients for different types of technology. Consult the Forecast Pro Statistical Reference Manual for details.



The example we are working with is a home electronic device. Our market research suggests the total market is 1 million units. A similar product had coefficients of innovation and imitation of 0.05 and 0.41 respectively. Edit the settings to match the ones above and click OK to build the model.

The graph shows the forecasts growing for the first eight years and then starting to decline. If you were to graph the forecasts on a cumulative basis (for example in Excel) the cumulative forecasts will resemble an elongated “S”. This characteristic shape is why the Bass model is often referred to as an S-curve model.

Right click *HE-6-years* on the Navigator to invoke the context menu and then select **Model>Bass Diffusion**.



Notice that now that we have more than 5 data points, Forecast Pro TRAC can automatically fit the coefficients and estimate the potential market from the

data. The estimated coefficients are pretty similar to the ones we used prior to having data, however, the estimate of the potential market is a good bit lower.

Forecasting sales for a new-to-world product prior to launch is extremely difficult. Regardless of the forecasting method used, you should be constantly revisiting your model assumptions as data becomes available and adjusting the model when appropriate.

This concludes Lesson 12.

Lesson 13

Using Weighting Transformations

Forecast Pro TRAC includes a weighting transformation which will divide your historical data by user-defined weights, forecast the resultant (deweighted) series and then multiply (reweight) the forecasts. This procedure can be useful in a variety of situations including adjusting for the number of working days in a month, defining a seasonal pattern and supplying a growth curve for a new product.

In this section we will use the weights procedure to adjust for the number of weeks in each month. The section will conclude with a discussion of how to apply weights in other situations.

Adjusting for 4 vs. 5 Week Periods

It is not uncommon for companies to divide the year into twelve periods each consisting of either four or five complete weeks. This is often referred to as a 4-4-5 calendar. In situations where the forecasts ultimately need to be broken down by week, this method may be preferable to using actual calendar months which include partial weeks.

If the number of weeks in each period is consistent from year to year (i.e., period 1 always has 4 weeks, period 2 always has 4 weeks, period 3 always has 5 weeks, etc.) then the variation due to the number of weeks in each period will be captured as part of the seasonality and no special action is required. In cases where the number of weeks in each period varies from year to year (i.e., some years period 1 has 4 weeks other years it has 5) a weighting transformation can be used to capture the variation due to how many weeks are in each period.

The procedure is very straightforward. You construct a weighting variable that classifies each period of the historical data and forecast period as containing either 4 or 5 weeks. Forecast Pro TRAC divides the historical data by the weights. (This converts sales per period into sales per week per period.) This deweighted series is forecasted. The forecasts are then reweighted by multiplying by the corresponding weights.

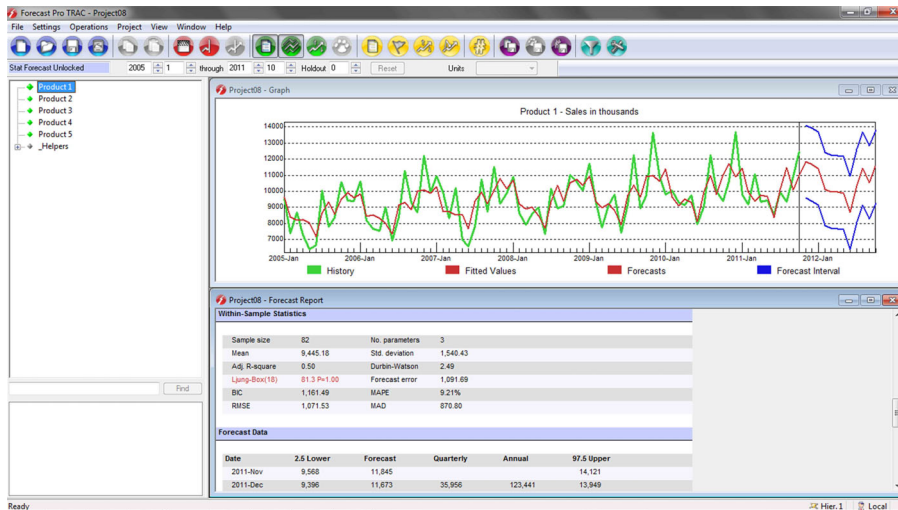
The data for this exercise are contained in two Excel files. *4-4-5 Data.xls* contains five time series that were collected using twelve 4 or 5 week periods per year. The number of weeks per period is not consistent from year to year. *4-4-5 Helper.xls* contains the *helper variable* “_Weeks”.

Helper variables are either weighting variables or event variables. They are identified by the use of a preceding or trailing underbar. They can either be placed in the same data file as the series they are helping or placed in their own separate file. In this example the helper variable _Weeks contains the number of weeks in each period. It covers the historical span as well as the forecast period.

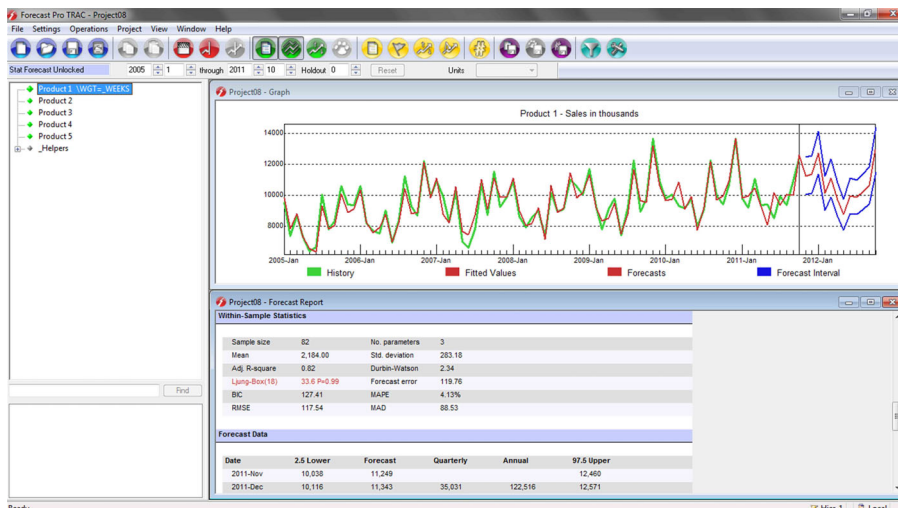
Select **Settings>Options** and make sure that the data mode is set to Xls and that the forecast horizon is set to 12. Create a script containing the two lines

```
4-4-5 Data
4-4-5 Helper
```

Read in the data and click the red Forecast icon to build the models. When the calculations are complete, make sure that the Graph and Forecast Report views are open, the fitted values are included on the graph and view the results for Product 1 (shown below). Notice that a seasonal model is selected and that the adjusted R-square is 0.50.



Right click on Product 1 to call up the Navigator's context menu. Select Weights and then select _Weeks.



The second model's superior fit and narrower confidence limits are easily discernible from a visual inspection of the graph. Notice that a seasonal model is selected and that the adjusted R-square is now 0.82.

Right click on Product 1 to call up the Navigator's context menu. Select **Apply Modifier(s) To>All Items**. Since the other four products all use the

same calendar, applying the weighting transformation improves the model in all cases.

Other Uses for Weighting Transformations

The weighting transformation is useful in a wide variety of situations. This section briefly notes some of them. Its purpose is to indicate some directions you may want to take with your own business data.

Trading day corrections. Many businesses are sensitive to the number of working days per period. Consider a service provider who is closed on the weekends. The number of working days in January (and all other months) will vary from year to year depending on how many weekend days happen to fall in any given month. If the number of working days has an impact on sales, then it needs to be accounted for in the model. A simple solution would be to use a weighting transformation where the weights consist of the number of working days per month.

User defined seasonality. At times you may wish to supply your own estimate of the seasonal pattern rather than trying to extract it directly from the data. This might be desirable if the data were short or very noisy. The weighting variable would consist of seasonal multipliers for the series. Since the seasonality is being handled by the weighting variable you may want to restrict the model selection to nonseasonal models (perhaps using a custom exponential smoothing model).

Product phase outs and other forecast adjustments. There may be times where you wish to alter the statistical forecasts using a weighting variable rather than the forecast adjustment facility. For example, let's say that you plan on discontinuing a product and wish to use the statistical forecast until the product is discontinued. You could create a weighting variable that consists of all ones during the history and the forecast periods prior to the discontinuation date and equals zero for all periods thereafter. If the product would be phased out over a three month period rather than ending abruptly, then you could use weights like .75, .5, .25 during the phase out period.

This concludes Lesson 13.

Lesson 14

Detecting and Correcting Outliers

An outlier is a data point that falls outside of the expected range of the data (i.e., it is an unusually large or small data point). If you are forecasting a time series that contains an outlier there is a danger that the outlier could have a significant impact on the forecast.

One solution to this problem is to screen the historical data for outliers and replace them with more typical values prior to generating the forecasts. This process is referred to as outlier detection and correction.

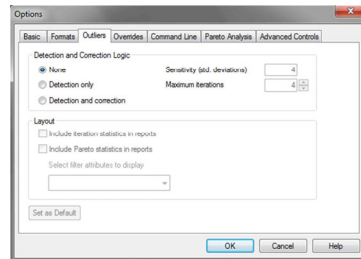
Correcting for a severe outlier (or building an event model for the time series if the cause of the outlier is known) will often improve the forecast. However if the outlier is not truly severe, correcting for it may do more harm than good. When you correct an outlier, you are rewriting the history to be smoother than it actually was and this will change the forecasts and narrow the confidence limits. This will result in poor forecasts and unrealistic confidence limits when the correction was not necessary.

It is the author's opinion that outlier correction should be performed sparingly and that detected outliers should be individually reviewed by the forecaster to determine whether a correction is appropriate.

Forecast Pro TRAC incorporates an automated algorithm to detect and (optionally) correct outliers. In this lesson we will explore its operation.

How Outlier Detection and Correction Works

Start Forecast Pro TRAC, select **Settings>Options** and display the Outliers tab.



There are three modes for outlier detection and correction.

None turns outlier detection and correction off. This is the default and many Forecast Pro TRAC users do not use (nor need to use) outlier detection.

Detection only will detect outliers and display the suggested corrected values, however, the forecasts will be generated using the uncorrected history.

Detection and correction will detect outliers and will automatically use the corrected values when generating forecasts.

The detection and correction algorithm works as follows:

1. The specified forecasting model is fit to the time series, the residuals (fitted errors) are generated and their standard deviation is calculated.
2. If the size of the largest error exceeds the outlier threshold, the point is flagged as an outlier and the historic value for the period is replaced with the fitted value.

3. The procedure is then repeated using the corrected history until either no outliers are detected or the specified maximum number of iterations is reached.

In a multiple-level problem the detection is only performed on the end items (i.e., the nongroup level). If the correction option has been selected, after all end items are corrected, the group level totals are reaggregated to reflect the corrected values.

You can adjust the *Sensitivity* setting to make the outlier threshold more or less sensitive. The proper setting will depend on the stability of your data set.

Set the detection and correction mode to *Detection only*, make sure the other settings match the selections shown above and click OK.

Reviewing the Outliers

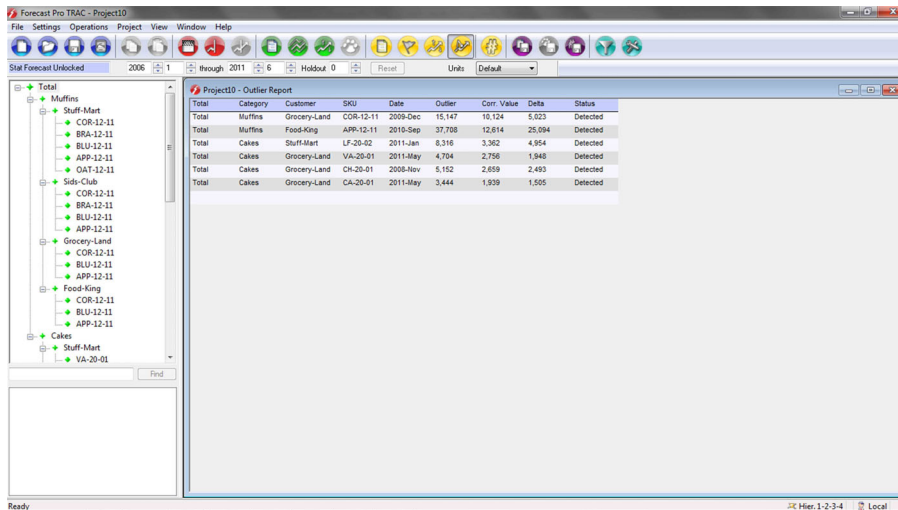
In this exercise we will perform the following steps:

1. Use the *Detection only* mode to identify the outliers.
2. Use the Outlier Report view and the Graph view to review the detected outliers and determine whether a correction is warranted.
3. Use the \OUTLIER=CORRECT modifier to correct the outliers that we feel should be corrected.

Make sure that the data mode is set to XLS and that the forecast horizon is set to 12. Create a script containing the single line

123 Bakery

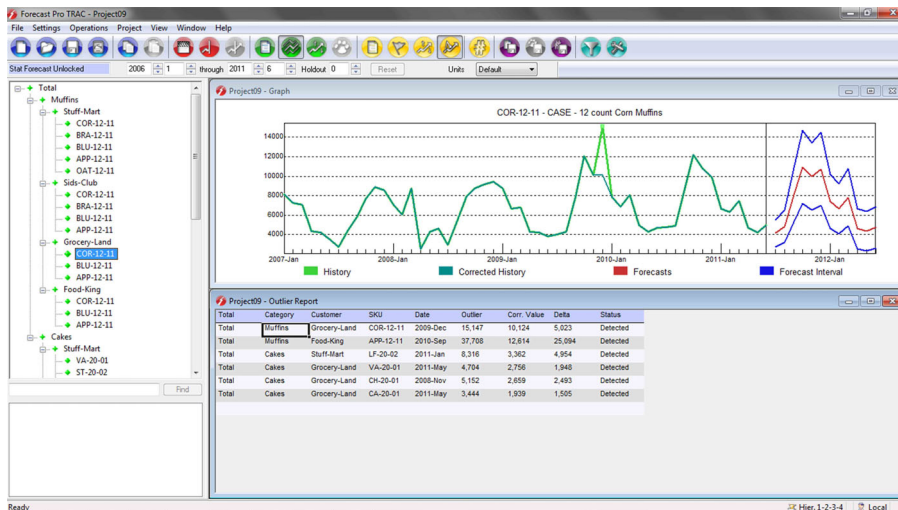
Read in the data and click the red Forecast icon to build the models. When the calculations are complete, click the yellow View Outlier Report icon () to open the outlier report view and turn off any other open views.



Notice that a total of 6 outliers have been detected and their current Status is *Detected*.

Correcting the Outliers

Open the Graph view and double click on the first item listed on the outlier report. Your display should now match the one shown below.



Notice that when you double clicked an item on the outlier report, the Navigator jumps directly to that item. Thus, you can use the outlier report as the equivalent of a Hot List to navigate through the listed items. All of the global report views (yellow icon views) support this kind of navigation.

Notice that the graph is displaying both the actual history for December 2009 and the suggested correction. The data point is rather unusual and you can see that the forecast has a small spike in December which is being driven by the outlier.

Right click the item on the Navigator (not the outlier report) to bring up the Navigator's context menu. Select **Outliers>Correct**. Notice that the status in the outlier report has changed to Corrected and that correcting for this outlier has changed the shape of the forecasts.

Double click on the next item on the outlier report. Here too, we have a fairly significant outlier and will want to correct for it. Examine the remaining items on the Hot List and experiment with the Outlier options on the Navigator's context menu. When you are comfortable with their operation, exit the program.

This concludes Lesson 14.

Lesson 15

Out-of-sample Testing

A good deal of the empirical knowledge about forecasting has come from comparisons of different methodologies. The M-Competition (Makridakis et al. [1982]) and M-3 Competition (Makridakis and Hibon [2000]) are the largest and most famous of these comparisons. Forecast Pro participated in the M-3 competition and outperformed all other software entrants and 16 out of 17 academic teams.

The rather simple comparison methodology for the original M-Competition was as follows.

The researchers assembled a collection of 1001 time series of yearly, quarterly and monthly data. The data were obtained from microeconomic, industry-level, macroeconomic and demographic sources. Twenty forecasting methods were tested for the entire sample of 1001 time series, and three on a subset of only 111 time series.

A sample of time points (6 for annual series, 8 for quarterly, 18 for monthly) was held out from the end of each time series. Each forecast model was fitted to the remaining data, and used to forecast the values of the holdout sample. The forecasts were then compared to the withheld data, and errors computed for each horizon, each time series and each forecast method. The errors were then summarized and analyzed in a variety of ways.

The most significant weakness in this methodology is that it uses only one forecast base for each time series, the last point in the fitting sample. One obtains only a “snapshot” of performance from one point in time. A forecast base just before or after a dramatic event in the data may completely change the results. Furthermore, you obtain only one forecast error for each horizon time from 1 to the end of the fit set. This procedure is referred to as a *static* evaluation.

Forecast Pro TRAC implements both a static and a *rolling base* evaluation. The rolling base procedure begins in the same way. However, after the forecasts have been made, the model is rolled forward by one period. Forecasts are then made from the new base to the end of the withheld data. This process is repeated until the withheld data sample is exhausted. If 6 data points have been withheld, then you obtain 6 1-step forecasts, 5 2-step forecasts, 4 3-step forecasts, etc.

The model coefficients are *not* reestimated as each additional data point is assimilated. The forecast model is based entirely upon the original fit set.

Setting Up the Script for Evaluation

Forecast Pro TRAC is shipped with data files containing the 111 series from the original M-competition. Annual contains 20 annual series, Quarterly contains 23 quarterly series, and Monthly contains 68 monthly series.

In this lesson we will compare the out-of-sample performance of two different forecasting techniques using the monthly data set. The main idea of this facility in Forecast Pro TRAC is to give you the opportunity to test options for time series from your own company. This lets you tune Forecast Pro TRAC to your data.

Click the red Script icon and on the first line enter:

M-data Monthly

Accept the script and then click the red Read Data icon to read in the data. Set the holdout sample on the dialog bar to 6. Click the red Forecast icon to create the forecasts.

Examining the Analytic Output

After processing is complete, select the group *Monthly* on the Navigator and view the *Out-of-Sample Rolling Evaluation for Items in Group* section of the Forecast Report view.

Forecast Pro TRAC - Project10

Project10 - Forecast Report

Minimum: 778,576
Maximum: 971,090

Out-of-Sample Rolling Evaluation for Items in Group

Hor / N / MAPE N	MAD	Cumulative MAD	MAPE	Cumulative MAPE	Below Upper Limit
1 / 408 / 408	762.07	762.07	9.01%	9.01%	96.32%
2 / 340 / 340	839.59	797.31	10.68%	9.77%	94.71%
3 / 272 / 272	1,065.74	868.89	12.45%	10.40%	94.12%
4 / 204 / 204	1,201.05	924.25	13.73%	11.03%	94.12%
5 / 136 / 136	1,184.31	940.26	16.24%	11.55%	91.18%
6 / 68 / 68	1,499.87	974.51	17.87%	11.85%	92.65%

Out-of-Sample Static Evaluation

Date	Forecast	Actual	AD	MAD	APE	MAPE
111-Jul	920,895.58	932,457.91	11,562.35	11,562.35	1.24%	1.24%
111-Aug	870,151.55	852,988.42	17,163.13	14,362.74	2.01%	1.63%
111-Sep	826,847.72	876,756.39	49,908.66	26,211.38	5.69%	2.98%
111-Oct	844,151.74	868,048.82	23,896.88	25,832.76	2.75%	2.92%
111-Nov	778,574.58	803,670.82	25,096.24	25,525.45	3.12%	2.98%
111-Dec	828,235.95	883,766.35	55,530.40	39,526.28	6.28%	3.52%

Overrides

There are no overrides for this item

The tables display the following information. Means are always taken over all the variables forecasted for a particular script line.

Hor is the forecast horizon.

N is the number of cases used to compute all statistics for this horizon other than the MAPE (see below).

MAPE N is the number of cases used to compute the MAPEs for this horizon. This can be less than the total number of forecasts for the horizon when some of the actuals are zero, thus preventing computation of the MAPE.

MAD is the Mean Absolute Deviation for the horizon, over all series on the current script line.

Cumulative MAD is the cumulative MAD for all horizons up to and including the current horizon.

MAPE is the Mean Absolute Percentage Error for the horizon, over all series on the current script line.

Cumulative MAPE is the cumulative MAPE for all horizons up to and including the current horizon.

GMRAE is the Geometric Mean of Relative Absolute Error for this horizon.

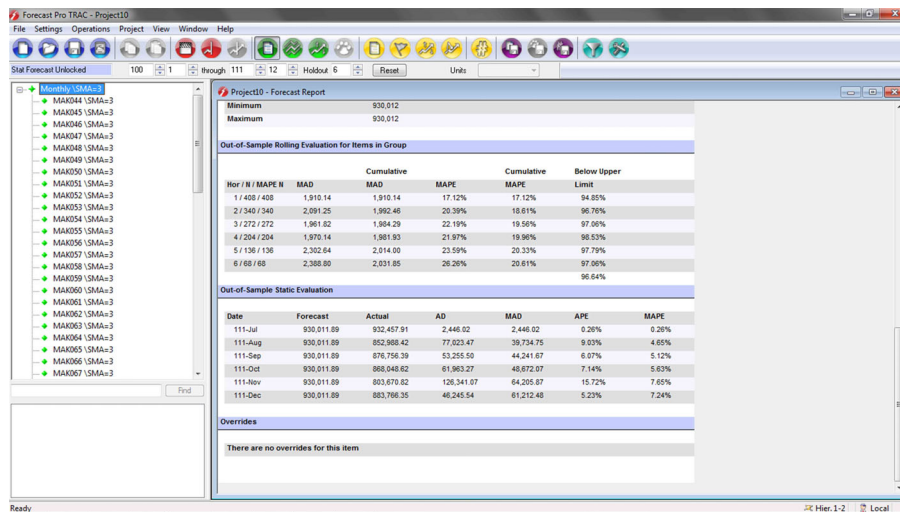
Below Upper Limit is the fraction of times that the actual was at or below the upper confidence limit as set in Settings Options. This allows you to calibrate the empirical upper limit to the theoretical upper limit. This is useful when you are using the upper limit to set stocking levels.

Figures listed in the row below the last forecast horizon refer to all horizons. Each group on the Navigator will produce such a report.

Comparing an Alternative Model

Right click *Monthly* on the Navigator to display the context menu. Select **Model>Very Simple Models>Simple Moving Average** and set the number of terms to 3. Then right click *Monthly* a second time and select **Apply Modifier(s) to>All items**. We have now forecasted all items using a 3-month simple moving average.

Select the group *Monthly* on the Navigator and view the *Out-of-Sample Rolling Evaluation for Items in Group* section of the Forecast Report view.



There are several ways to compare the results of this forecast and our expert selection forecast. The most common approach is to look at the MAPEs (Mean Absolute Percent Error) for the two. In our example, the MAPEs for expert selection are lower than the MAPEs for the moving averages for every time horizon—clear evidence that expert selection outperforms the moving averages.

The other comparison statistic that can be used, is the GMRAE (Geometric Mean of Relative Absolute Error). This statistic is calculated using the relative error between the naive model and the currently selected model. A GMRAE of 0.55 indicates that the size of the current model's error is only 55% of the size of the error generated using the naive model for the same data set. In our example the GMRAEs for expert selection are lower than the GMRAEs for the moving averages—further evidence that expert selection outperforms the moving averages.

This concludes Lesson 15.

REFERENCE

Chapter 1

Setting Up Your Data

Forecast Pro TRAC requires historic data to be input in a specific format. For many users, the data format is an initial stumbling block on the way to success in forecasting their own data. This usually happens when a user misunderstands some of the details of the data format. This chapter explains the data formats supported by Forecast Pro TRAC, advises you how to select a format, and describes how to create the files. If you read the material carefully, and examine the sample data files that are shipped with Forecast Pro TRAC, you will be up and running quickly.

The first two sections describe data requirements and the different data file formats. After you have selected your file format, consult the appropriate section for instructions on how to create the files.

Overview

Forecast Pro TRAC works with historic time series, i.e., sequences of values of a variable at some time interval. Business series are usually expressed in terms of the calendar, and can be daily, weekly, monthly or quarterly. Forecast Pro TRAC can work with any type of time series, but is oriented towards weekly, monthly and quarterly calendar data.

Collection and maintenance of reliable historic data is up to you and your IT department, and can be implemented in many different ways, depending on information flow conditions in your organization.

Data length

Forecast Pro TRAC works by fitting a statistical model to your historic data and extrapolating it via the fitted model. Thus, your data must be long enough to provide reasonably stable estimates of the most important features of the data. Very short or very noisy historic records usually yield very simple models because the data are too short to support statistical estimates of important features like seasonality.

If the data are very short, say *four points or fewer*, Forecast Pro TRAC can pick up neither seasonality nor trend, and reverts to the Simple Moving Average model.

For *more than four points but less than two years worth of data*, Forecast Pro TRAC can fit and forecast trends but not seasonality. If your data are in fact nonseasonal, your forecasts are likely to be adequate. If your data are in fact seasonal, the forecasts are likely to be poor—Forecast Pro TRAC cannot extract or forecast the seasonality and part of the seasonality may be mistaken for trending.

However, seasonal forecasts from short data sets are feasible when the short data sets are nested within aggregate product groups with longer histories. The seasonality of the aggregate can be “borrowed” and applied to the short data sets. See the section entitled Multiple-level Scripts in the next chapter for details.

Seasonality can be estimated and forecasted *from two to three years of data* but this amount of data is marginal, especially when your data are noisy or intermittent. In some cases, patterns in the noise are mistaken for seasonality, yielding inappropriate “seasonal” forecasts.

Robust capture of seasonality requires *three or more years* of data. *Four to seven years* is even better, since there is more information from which the program can separate seasonality and trend from the noise.

There is little additional payoff in accuracy *beyond about seven years* of data, and the cost in computer time can be substantial.

Missing values and zeros

Each of the statistical forecasting methods requires an unbroken stream of historic values. Unfortunately, however, missing values are common in business data. You therefore need a well-formulated approach to missing data. There are two parts to the approach. You must first decide how to encode missing values in the input data file. Then you must decide how these missing values are to be treated by Forecast Pro TRAC.

The encoding of missing values depends upon the data format. However, one problem is common to all of the formats—the distinction between missing values and zeroes. Forecast Pro TRAC ordinarily considers zeroes to be actual data values and treats them as such. If they were really intended as missing values, then the forecasts can be badly biased.

Forecast Pro TRAC treats a sequence of leading zeroes as missing values if you check “Ignore leading zeroes” on the Formats tab of the **Settings>Options** dialog box and it treats trailing zeroes as missing if you check “Ignore trailing zeroes”. If you can avoid using this strategy, do so. Its dependence upon these flag settings makes it a little risky.

Zeroes in the middle of your data are *always* treated as numerical values. Therefore, embedded missing values *must be* explicitly coded as missing. Since the way you do this depends upon the data format, it will be addressed as we discuss each specific data format.

Forecast Pro TRAC interprets your input data and missing values as the data are read. Thus you cannot change treatment of missing data for a data set that has already been read except by rereading it from scratch. The interpretation of zeros and missing values depends upon the “Ignore leading zeroes” and “Ignore trailing zeroes” flags, and upon the “Missing values” setting on the Formats tab of the **Settings>Options** dialog box. There are three possible settings for missing values—*Truncate*, *Impute* or *Zero*.

Truncate directs Forecast Pro TRAC to use only the most recent unbroken stream of data. All data up to and including the last missing value are discarded.

Impute directs Forecast Pro TRAC to discard leading and trailing missing values but to impute embedded missing values via linear interpolation.

Zero directs Forecast Pro TRAC to reset missing values to zeroes and to treat them as numerical values. This setting is appropriate when the data file is written from a database in which only the non-zero records are stored. In other cases it might lead to badly biased forecasts.

Header information

You will need to collect not only the time series data, but also certain *header* information. The header information includes the following.

Variable name. The name by which the program refers to an individual item (often an SKU). An item name is limited to 256 of the following characters:

0-9 A-Z a-z ! # \$ % & ? @ _ + - / * . ~ < >

However, you may also be limited by restrictions imposed by the software to which you export your data. SQL databases, for instance, sometimes require that the first character in a name is a letter, and do not regard upper and lower cases as distinct.

If the variable name begins or ends with an underbar (_), Forecast Pro TRAC tags it as a potential helper variable and will not forecast it. Helper variables are used for event modeling and weighting transformations.

Variable description. A short description of the variable. Variable descriptions must not exceed 256 characters in length. Variable descriptions are displayed within Forecast Pro TRAC and can be included in Numeric Output Files and Forecast Report Files.

Starting year and period. The year and period corresponding to the first available data point. If the first available observation for a monthly series was April, 2001 then the starting year would be 2001 and the starting period would

be 4. The starting year must be 100 or later. For data that are not calendar-oriented, enter 100 for the starting year and 1 for the starting period.

Periods per year. 12 for monthly data, 4 for quarterly data, etc. For data that is not calendar oriented, use 1. Note that most weekly corporate calendars involve occasional years of 53 weeks—these occurrences will cause the forecast date tags to be off by a week.

Periods per cycle. The number of periods per seasonal cycle, usually equal to the number of periods per year. An exception might be daily data, where periods per cycle could be set to 7 to capture weekly patterns and periods per year set to 365. Or, if weekend days are excluded, periods per cycle might be 5 and periods per year 260. For nonseasonal data, periods per cycle should be 1. This is a critical entry because Forecast Pro TRAC uses it for seasonal adjustments.

Selecting a Data Format

The program accepts three different data formats—Text (MLT), Spreadsheet (XLS, XLSX, WK* & CSV) and Open Database Connectivity (ODBC). Examples of each file type are shipped with the program.

Which data format you choose will depend on your application and database operations. Before making your choice you should be aware of the following advantages and disadvantages of each file type.

Spreadsheet (XLS, XLSX, WK* & CSV) files

Uses Excel and Lotus format spreadsheets or CSV (Comma Separated Values) files saved from Excel to hold data. You can make and forecast multiple spreadsheet files on one script if you wish.

PROS. If you are comfortable using a spreadsheet then the spreadsheet format allows you to create, update and manipulate your data in a familiar environment. Processing time for xls files is faster than for ODBC. Creating forecast reports from Excel is straightforward.

CONS. The layout of your spreadsheet must follow the Forecast Pro TRAC rules. You may have to change your current spreadsheet layout to one you

find slightly less convenient. Processing time for xlsx files is slow (xls is faster and csv is faster still).

Text (CSV, MLT) files

Uses text files to hold data. You can make and forecast multiple MLT files on one script if you wish.

PROS. Processing time is faster than for ODBC and spreadsheets (excluding CSV which is text-based). Most databases can output text files.

CONS. Editing, viewing and updating large MLT files can be clumsy. Not all editors accept very long files.

ODBC

Open database connectivity (ODBC) allows Forecast Pro TRAC to read and write data directly to databases for which an ODBC driver exists. Most popular databases support ODBC including Access, Oracle and SQL server.

PROS. ODBC can provide direct access to data stored in the corporate database obviating the need for intermediate files.

CONS. Reading and writing directly to the corporate database can raise security issues. Data transfer can be slow for some configurations.

The next three sections supply the details you need to set up your data in one of the Forecast Pro TRAC formats. If you have chosen a format, you need read only the pertinent section.

Spreadsheet Formats

Forecast Pro TRAC can read Excel (XLS, XLSX) files, Lotus (WK1, WK3 and WK4) files and CSV (Comma Separated Values) files saved from Excel.

You must create your spreadsheet file from within your spreadsheet program. Forecast Pro TRAC checks data types as it reads the spreadsheet. If it sees text where it expects a number, or a floating point number where it expects an integer, an error message will be displayed. A blank cell is interpreted as a

missing value. Do not use zeros to represent missing values—they will be interpreted as numbers and will probably distort your forecasts badly.

Entire spreadsheet vs. named range

You may either devote an entire worksheet to the data (recommended) or specify a portion of a worksheet by giving it the range name BFSDATA.

In a multi-worksheet workbook the data are assumed to reside in the first (topmost) worksheet unless an alternate sheet has been specified by naming it BFSDATA.

The cell references in the examples below assume that the entire worksheet has been devoted to the Forecast Pro TRAC database. If you opt to specify a named range, cell A1 in the samples will correspond to the cell in the uppermost left corner of your named range.

Row format

If your data are already stored by rows, you will want to consider the row format first. You can probably alter your spreadsheet to the Forecast Pro TRAC row layout in just a few minutes. In row format each time series occupies a single row on the spreadsheet.

The data are assumed to reside in the topmost (first) spreadsheet in the workbook unless an alternate sheet has been specified by naming it BFSDATA.

Row 1 of the spreadsheet is devoted to column headings. The keyword “description” *must* be used as the column heading for the description column. The other cells in row 1 are ignored by Forecast Pro TRAC. You can use them for titles, calendar information, etc.

Here is an example of a row format spreadsheet.

	A	B	C	D	E	F	G	H	I	J	K	L
	Variable Name	Description	Starting Year	Starting Period	Periods Per Year	Periods Per Cycle	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03
2	PG1-204-1	2" Bolt Anchors	2002	11	12	12	24	18	39	23	25	24
3	PG1-204-2	4" Bolt Anchors	2002	11	12	12			74	77	102	71
4	PG1-204-3	2" Staple Anchors	2002	11	12	12				103	157	114
5	PG1-203-4	3" Staple Anchors	2002	11	12	12	101	90	88	54	52	44
6	PG1-203-5	4" Staple Anchors	2002	11	12	12	109	90	75	109	199	129

The above example does not use attribute fields to define product groupings. This is often desirable and is discussed in the *Using attribute fields to define a hierarchy* section.

In our example, each data record consists of six header items in columns A through F, followed by the historic data in the remainder of the row, beginning in column G. Each item is placed in a separate cell.

Columns A through F contain the following six items required items.

- A Variable name. Up to 256 characters.
- B Variable description. Up to 256 characters.
- C Starting year. Must be an integer.
- D Starting period. Must be an integer.
- E Periods per year. Must be an integer.
- F Periods per seasonal cycle. Must be an integer.

See the Overview section at the beginning of this chapter for more details on these items.

The time series data begin in column G. The starting year (column C) and starting period (column D) refer to the year and period for column G, whether or not that cell actually contains data. Thus, in the example spreadsheet, the first value for PG-204-2 is for January 2003 in column I, even though the header defines the starting period as 11 and the starting year as 2002.

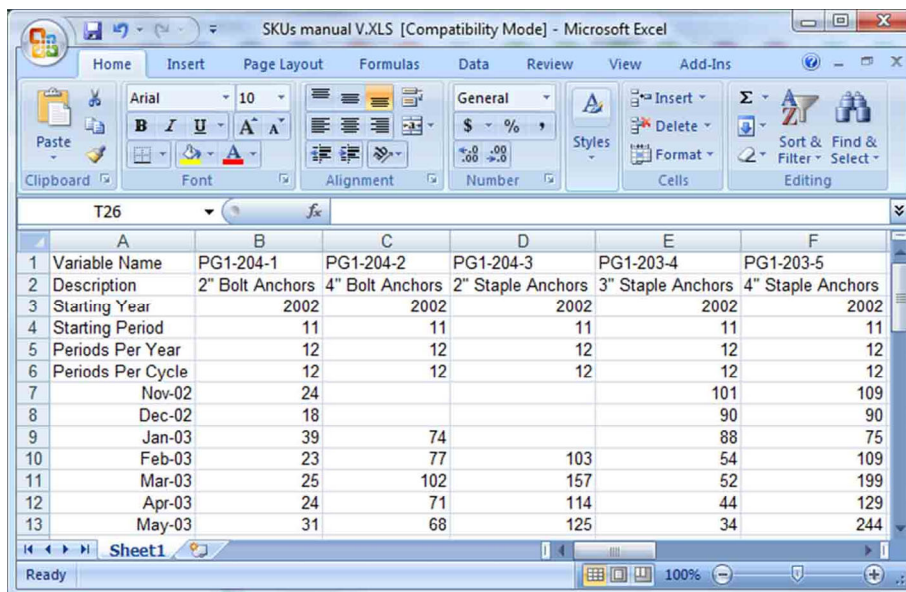
Column format

If your data are already stored by columns, you will want to consider the column format first. You can probably alter your spreadsheet to the Forecast Pro TRAC row layout in just a few minutes. In column format each time series occupies a single column on the spreadsheet.

The data are assumed to reside in the topmost (first) spreadsheet in the workbook unless an alternate sheet has been specified by naming it BFSDATA.

Column A of the spreadsheet is devoted to row headings. The keyword “description” *must* be used as the row heading for the description row. The other cells in column A are ignored by Forecast Pro TRAC. You can use them for titles, calendar information, etc.

Here is an example of a column format spreadsheet.



	A	B	C	D	E	F
1	Variable Name	PG1-204-1	PG1-204-2	PG1-204-3	PG1-203-4	PG1-203-5
2	Description	2" Bolt Anchors	4" Bolt Anchors	2" Staple Anchors	3" Staple Anchors	4" Staple Anchors
3	Starting Year	2002	2002	2002	2002	2002
4	Starting Period	11	11	11	11	11
5	Periods Per Year	12	12	12	12	12
6	Periods Per Cycle	12	12	12	12	12
7	Nov-02	24			101	109
8	Dec-02	18			90	90
9	Jan-03	39	74		88	75
10	Feb-03	23	77	103	54	109
11	Mar-03	25	102	157	52	199
12	Apr-03	24	71	114	44	129
13	May-03	31	68	125	34	244

The above example does not use attribute fields to define product groupings. This is often desirable and is discussed in the *Using attribute fields to define a hierarchy* section.

In our example, each data record consists of six header items in rows 1 through 6, followed by the historic data in remainder of the rows, beginning in row 7. Each item is placed in a separate cell.

Rows 1 through 6 contain the following six required items.

- 1 Variable name. Up to 256 characters.
- 2 Variable description. Up to 256 characters.
- 3 Starting year. Must be an integer.
- 4 Starting period. Must be an integer.
- 5 Periods per year. Must be an integer.
- 6 Periods per seasonal cycle. Must be an integer.

See the Overview section at the beginning of this chapter for more details on these items.

The time series data begin in row 7. The starting year (row 3) and starting period (row 4) refer to the year and period for row 7, whether or not that cell actually contains data. Thus in the example spreadsheet, the first value for PG1-204-2 is for January 2003 in row 9, even though the header defines the starting period as 11 and the starting year as 2002.

Formatting rules

Keep the following points in mind when you are creating your spreadsheet.

If you are not using attribute fields each variable name must be unique.

If you are using attribute fields each variable name within a given group must be unique.

If you use zeroes to pad the data prior to an item's availability, make sure that Ignore leading zeros is selected on the Formats tab of the Settings Options dialog box.

Text (MLT) Formats

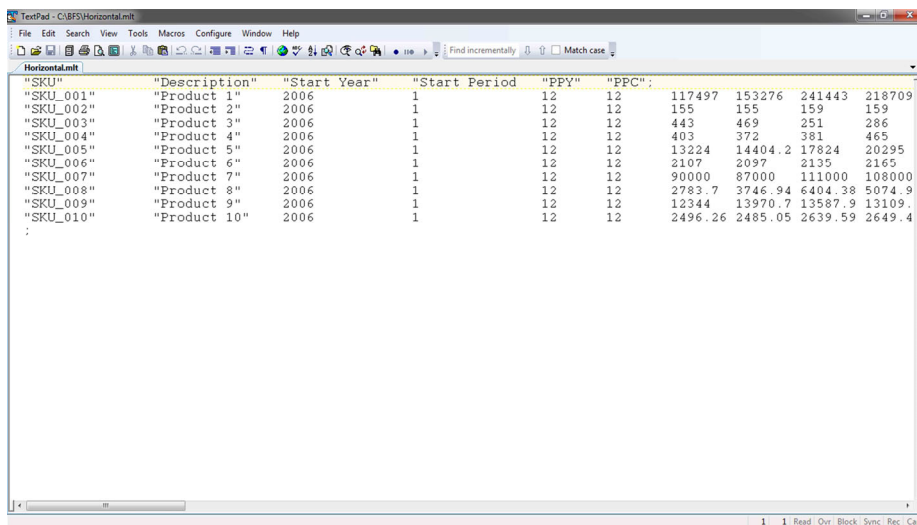
A multivariate text file contains information for all the series you wish to forecast from a single line of the script file.

This file is stored as an editable text file with the extension MLT. You must create this file outside of the program, making sure that you format it appropriately.

The MLT file format is straightforward. The file begins with record headings followed by a semicolon. The record headings are required for the Variable Name and Description fields and are optional for all other records. You can use them for titles, calendar information, etc. if you wish.

After the record headings comes header information for the first variable, followed by decimal numbers representing the historical data and then a semicolon. This is followed by the same format for subsequent time series. Two semicolons in a row mark the end of the MLT file.

Since Forecast Pro TRAC recognizes spaces, tabs and returns as equivalent terminators, you have a great deal of flexibility in formatting your data. The most common format is to organize series by rows, as in the following example.



"SKU"	"Description"	"Start Year"	"Start Period"	"PPV"	"PPC"
"SKU_001"	"Product 1"	2006	1	12	12
"SKU_002"	"Product 2"	2006	1	12	12
"SKU_003"	"Product 3"	2006	1	12	12
"SKU_004"	"Product 4"	2006	1	12	12
"SKU_005"	"Product 5"	2006	1	12	12
"SKU_006"	"Product 6"	2006	1	12	12
"SKU_007"	"Product 7"	2006	1	12	12
"SKU_008"	"Product 8"	2006	1	12	12
"SKU_009"	"Product 9"	2006	1	12	12
"SKU_010"	"Product 10"	2006	1	12	12

The above example does not use attribute fields to define product groupings. This is often desirable and is discussed in the *Using attribute fields to define a hierarchy* section below.

The header consists of the first six items:

Variable name. Up to 256 characters enclosed in quotes.

Variable description. Up to 256 characters enclosed in quotes.

Starting year. Must be an integer.

Starting period. Must be an integer.

Periods per year. Must be an integer.

Periods per seasonal cycle. Must be an integer.

See the Overview section at the beginning of this chapter for more details on these items.

The remaining fields contain historic data. Each time series is terminated with a semicolon, and the file is terminated with two semicolons.

The one-time-series-per-line format illustrated above is easy to read, however, keep in mind you can use any combination of rows and columns.

Formatting rules

Keep the following points in mind when you are creating your .MLT files.

The record headers, variable name field and variable description field must always appear in quotes.

If you are not using attribute fields, each variable name must be unique. If you are using attribute fields, each variable name within a given group must be unique.

If you plan to use commas to separate items, or as place holders for large numbers, you will need to set a few options on the format tab of the Settings Options dialog box to insure that they are interpreted correctly.

Be careful not to use dollar signs, page breaks or other symbols that may confuse Forecast Pro TRAC.

Use the word MISSING instead of a number to indicate a missing value.

If you use zeroes to pad the data prior to an item's availability, make sure that Ignore leading zeros is selected on the Formats tab of the Settings Options dialog box.

Using ODBC

ODBC provides direct data communications between Forecast Pro TRAC and a wide variety of databases. This is accomplished through intermediary ODBC drivers that lie between Forecast Pro TRAC and your database. You must obtain the driver from the database manufacturer or a third party and install it according to the directions provided.

ODBC drivers are available for many database products including Access, Oracle, DB2, SQL Server, FoxPro, Paradox and Btrieve.

Database structure

Forecast Pro TRAC reads data from structured tables or views defined in the database. Ordinarily, the tables created for the Forecast Pro TRAC interface are just a subset of the entire database.

Here is an example of a of a data table formatted for Forecast Pro TRAC.

ItemId0	Description	Hist_Year	Hist_Period	Ppy	Ppc	Hist_Value
COR-12-11	CASE - 12 count Corn Muffins	2005	6	12	12	1944
COR-12-11	CASE - 12 count Corn Muffins	2005	7	12	12	3888
COR-12-11	CASE - 12 count Corn Muffins	2005	8	12	12	5832
COR-12-11	CASE - 12 count Corn Muffins	2005	9	12	12	8748
COR-12-11	CASE - 12 count Corn Muffins	2005	10	12	12	16524
COR-12-11	CASE - 12 count Corn Muffins	2005	11	12	12	16524
COR-12-11	CASE - 12 count Corn Muffins	2005	12	12	12	23328
COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12	17496
COR-12-11	CASE - 12 count Corn Muffins	2006	2	12	12	2916
COR-12-11	CASE - 12 count Corn Muffins	2006	3	12	12	6804
COR-12-11	CASE - 12 count Corn Muffins	2006	4	12	12	17496
COR-12-11	CASE - 12 count Corn Muffins	2006	5	12	12	1944
COR-12-11	CASE - 12 count Corn Muffins	2006	6	12	12	9720
COR-12-11	CASE - 12 count Corn Muffins	2006	7	12	12	3888
COR-12-11	CASE - 12 count Corn Muffins	2006	8	12	12	5832
COR-12-11	CASE - 12 count Corn Muffins	2006	9	12	12	12505.5
COR-12-11	CASE - 12 count Corn Muffins	2006	10	12	12	17496
COR-12-11	CASE - 12 count Corn Muffins	2006	11	12	12	13608
COR-12-11	CASE - 12 count Corn Muffins	2006	12	12	12	23328
COR-12-11	CASE - 12 count Corn Muffins	2007	1	12	12	26244
COR-12-11	CASE - 12 count Corn Muffins	2007	2	12	12	10692
COR-12-11	CASE - 12 count Corn Muffins	2007	3	12	12	14580
COR-12-11	CASE - 12 count Corn Muffins	2007	4	12	12	3888
COR-12-11	CASE - 12 count Corn Muffins	2007	5	12	12	6804
COR-12-11	CASE - 12 count Corn Muffins	2007	6	12	12	6804
COR-12-11	CASE - 12 count Corn Muffins	2007	7	12	12	6804
COR-12-11	CASE - 12 count Corn Muffins	2007	8	12	12	6804

The above example does not use attribute fields to define product groupings. This is often desirable and is discussed in the *Using attribute fields to define a hierarchy* section.

In our example, each data record consists of six header items in columns 1 through 6, followed by the corresponding historic data point. It is important to note that each data record must contain the aggregated value for the given period.

The fields are defined as follows.

ItemId0. This is a text field containing the variable name. It can be up to 256 characters.

Description. This is a text field containing the variable description. It can be up to 256 characters.

Hist_Year. This is a number field with field size double containing the year.

Hist_Period. This is a number field with field size double containing the period.

Ppy. This is a number field with field size double containing the periods per year.

Ppc. This is a number field with field size double containing the periods per cycle.

Hist_Value. This is a number field with field size double containing the aggregated historic data value for the record's "date" as defined by the *Hist_Year* and *Hist_Period*.

See the Overview section at the beginning of this chapter for more details on these items.

To connect to an ODBC database you set the data mode to ODBC in **Settings**, and then select **Operations>ODBC Connect**. You will be prompted to establish the file data source (select an ODBC driver) and then to select a database.

When you invoke the Define Script dialog box, the list box to the right includes all tables from your database that *do not* end with an underbar (_), including those that have nothing to do with Forecast Pro TRAC. A table from the database is treated just like a file when you are using one of the file data modes. Thus you should arrange data into the tables or views that make logical sense as entries in the script.

Formatting rules

ODBC drivers vary a great deal. If you experience any difficulties connecting to the database, the first thing to check is that you are using the latest ODBC driver available for your database.

With the exception of the last one (which only pertains to Oracle) all of the notes below have been verified using Microsoft Access. There is a chance that your ODBC driver might be more (or less) restrictive.

Missing values are indicated by whatever rules are used by the native database. Every database recognizes the distinction between zeroes and missing values. If you want, you can encode leading and trailing missing values as zeroes. In that case you must make sure that "Ignore leading zeros" and/or "Ignore trailing zeroes" is selected on the Format tab of the **Settings Options** dialog box.

Table names and variable names should begin with a letter and should not include blank spaces.

If you are not using attribute fields each variable name must be unique.

If you are using attribute fields each variable name within a given group must be unique.

Oracle Users: Some Oracle drivers will only work if the Hist_Value field is defined as FLOAT (not NUMBER). All other numeric fields can be NUMBER with the decimal places set to zero.

Using Attribute Fields to Define a Hierarchy

If you do not include any attribute fields, when you read the data into Forecast Pro TRAC, it will create a one-level hierarchy (i.e., there will be no group totals).

If your data file, table or query includes attribute fields prior to the Variable Name field, Forecast Pro TRAC will automatically build a multiple-level hierarchy. The first level of the hierarchy will correspond to the first attribute field, the second level of the forecasting hierarchy will correspond to the second attribute field, etc.

Let's illustrate this with an example. The spreadsheet *123 Bakery.xls* is a sample data file shipped with Forecast Pro TRAC. It is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M
		Category	Customer	SKU	Description	Starting Year	Starting Period	Periods Per Year	Periods Per Cycle	Jan-06	Feb-06	Mar-06	Apr-06
1	Total	Muffins	Stuffs-Mart	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
2	Total	Muffins	Stuffs-Mart	BRA-12-11	CASE - 12 count Bran Muffins	2006	1	12	12	20,829	72,576	11,016	
3	Total	Muffins	Stuffs-Mart	BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12				
4	Total	Muffins	Stuffs-Mart	APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	6,763	7,661	9,561	6
5	Total	Muffins	Stuffs-Mart	OAT-12-11	CASE - 12 count Oatmeal Muffins	2006	1	12	12	21,042	0	0	
6	Total	Muffins	Sids-Club	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
7	Total	Muffins	Sids-Club	BRA-12-11	CASE - 12 count Bran Muffins	2006	1	12	12	3,572	4,000	2,808	5
8	Total	Muffins	Sids-Club	BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12	15,307	1,866	3,477	6
9	Total	Muffins	Sids-Club	APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	25,404	450	906	4
10	Total	Muffins	Grocery-Land	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
11	Total	Muffins	Grocery-Land	BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12	7,383	6,512	4,375	3
12	Total	Muffins	Grocery-Land	APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	21,729	13,780	9,072	6
13	Total	Muffins	Food-King	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
14	Total	Muffins	Food-King	BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12				
15	Total	Muffins	Food-King	APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12				
16	Total	Cakes	Stuffs-Mart	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12	0	840	18,480	15
17	Total	Cakes	Stuffs-Mart	ST-20-02	CASE - 20 oz. Strawberry Pound Cake	2006	1	12	12	1,563	1,143	1,767	1
18	Total	Cakes	Stuffs-Mart	LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12	824	2,494	1,767	2
19	Total	Cakes	Stuffs-Mart	LE-20-02	CASE - 20 oz. Lemon Pound Cake	2006	1	12	12	1,351	1,975	1,767	3
20	Total	Cakes	Stuffs-Mart	CO-20-01	CASE - 20 oz. Coconut Layer Cake	2006	1	12	12	0	0	4,368	3
21	Total	Cakes	Stuffs-Mart	CH-20-01	CASE - 20 oz. Chocolate Layer Cake	2006	1	12	12	0	0	9,240	9
22	Total	Cakes	Stuffs-Mart	CA-20-01	CASE - 20 oz. Carrot Layer Cake	2006	1	12	12	0	0	14,280	11
23	Total	Cakes	Stuffs-Mart	BU-20-02	CASE - 20 oz. Butter Pound Cake	2006	1	12	12	5,715	1,035	2,595	5
24	Total	Cakes	Sids-Club	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12	12,061	9,072	10,872	15
25	Total	Cakes	Sids-Club	LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12				
26	Total	Cakes	Sids-Club	CO-20-01	CASE - 20 oz. Coconut Layer Cake	2006	1	12	12	20,196	12,672	18,144	24
27	Total	Cakes	Sids-Club	CH-20-01	CASE - 20 oz. Chocolate Layer Cake	2006	1	12	12				
28	Total	Cakes	Sids-Club	CA-20-01	CASE - 20 oz. Carrot Layer Cake	2006	1	12	12	8,964	6,480	7,920	12
29	Total	Cakes	Sids-Club	BU-20-02	CASE - 20 oz. Butter Pound Cake	2006	1	12	12				
30	Total	Cakes	Grocery-Land	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12				
31	Total	Cakes	Grocery-Land	LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12	1,479	2,474	3,271	1
32	Total	Cakes	Grocery-Land	BU-20-02	CASE - 20 oz. Butter Pound Cake	2006	1	12	12				

In our example, our first attribute field is Total. Notice that the value for the field Total is “Total” for all items. Since all items have the same value for the first attribute field, when we read this spreadsheet into Forecast Pro TRAC the first level of our forecasting hierarchy will provide a grand total for all items in our spreadsheet. Notice that the next attribute field is Category, which contains both Muffins and Cakes. Thus, when we read this spreadsheet into Forecast Pro TRAC the second level of our forecasting hierarchy will breakdown total sales into Muffins and Cakes. The next attribute field is Customer. Thus, the third level of our forecasting hierarchy will breakdown the Muffins and Cakes into Customers. The next field is the Variable Name (labeled “SKU”) so the final level of our hierarchy will breakdown the Category-by-Customer into SKUs.

The order of appearance on the spreadsheet dictates the structure of the hierarchy so you’ll want to take care when constructing your spreadsheet. Often this entails sorting your spreadsheet on the attribute fields prior to reading it into Forecast Pro TRAC.

If you use a pivot tables in Excel to create your input files the resulting spreadsheet will only include records in the attribute fields when the attributes change. Thus, the data in our example would be represented as shown below.

1	Total	Category	Customer	SKU	Description	Starting Year	Starting Period	Periods Per Year	Periods Per Cycle	Jan-06	Feb-06	Mar-06	Apr-06
2		Muffins	Stuff-Mart	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
3				BRA-12-11	CASE - 12 count Bran Muffins	2006	1	12	12	20,829	72,576	11,016	
4				BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12				
5				APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	6,763	7,661	9,561	6
6				OAT-12-11	CASE - 12 count Oatmeal Muffins	2006	1	12	12	21,042	0	0	
7			Sids-Club	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
8				BRA-12-11	CASE - 12 count Bran Muffins	2006	1	12	12	3,572	4,000	2,808	5
9				BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12	15,307	1,866	3,477	6
10				APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	25,404	450	906	4
11			Grocery-Land	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
12				BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12	7,383	6,512	4,375	3
13				APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12	21,729	13,780	9,072	6
14			Food-King	COR-12-11	CASE - 12 count Corn Muffins	2006	1	12	12				
15				BLU-12-11	CASE - 12 count Blueberry Muffins	2006	1	12	12				
16				APP-12-11	CASE - 12 count Apple Muffins	2006	1	12	12				
17			Cakes	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12	0	840	18,480	15
18				ST-20-02	CASE - 20 oz. Strawberry Pound Cake	2006	1	12	12	1,563	1,143	1,767	1
19				LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12	824	2,494	1,767	2
20				LE-20-02	CASE - 20 oz. Lemon Pound Cake	2006	1	12	12	1,351	1,975	1,767	3
21				CO-20-01	CASE - 20 oz. Coconut Layer Cake	2006	1	12	12	0	0	4,368	3
22				CH-20-01	CASE - 20 oz. Chocolate Layer Cake	2006	1	12	12	0	0	9,240	9
23				CA-20-01	CASE - 20 oz. Carrot Layer Cake	2006	1	12	12	0	0	14,280	11
24				BU-20-02	CASE - 20 oz. Butter Pound Cake	2006	1	12	12	5,715	1,035	2,595	5
25			Sids-Club	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12	12,061	9,072	10,872	15
26				LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12				
27				CO-20-01	CASE - 20 oz. Coconut Layer Cake	2006	1	12	12	20,196	12,672	18,144	24
28				CH-20-01	CASE - 20 oz. Chocolate Layer Cake	2006	1	12	12				
29				CA-20-01	CASE - 20 oz. Carrot Layer Cake	2006	1	12	12	8,964	6,480	7,920	12
30				BU-20-02	CASE - 20 oz. Butter Pound Cake	2006	1	12	12				
31			Grocery-Land	VA-20-01	CASE - 20 oz. Vanilla Layer Cake	2006	1	12	12				
32				LF-20-02	CASE - 20 oz. Low-Fat Pound Cake	2006	1	12	12	1,479	2,474	3,771	1

Forecast Pro TRAC will read spreadsheets formatted in this fashion properly.

ODBC attribute fields

If you are using ODBC the first attribute field *must* be named ItemId0, the second attribute field must be named ItemId1, etc. All attribute fields must be text fields.

Defining the Secondary File

Forecast Pro TRAC uses a second input file, table or query to bring in item-level conversion factors, custom filter fields and exception report thresholds. When Forecast Pro TRAC reads in a data file, table or query it looks for a corresponding “secondary” file, table or query. The convention used to associate a secondary file with a data file, is to use the same filename with “_Secondary” appended to it. For example, if the input filename is *Data.xls* the corresponding secondary file must be named *Data_Secondary.xls*.

Examine the file *123 Bakery_Secondary.xls*.

123 Bakery_Secondary [Compatibility Mode] - Microsoft Excel																													
File Home Insert Page Layout Formulas Data Review View Add-Ins AppBelt.com																													
AF55																													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R											
1	Total	Category	Customer	SKU	Dollars	Pounds	Pallets	filter-Custom	Pareto	filter-Sales	Rep	FVH	MINP	FVH	MAXP	FVH	MIN	FVH	MAX	FR	MIN	FR	MAX	MAPE	MAX	MAD	MAX	FVA	M
2	Total	Muffins	Stuff-Mart	COR-12-11	\$11.62	7.1	0.111	A		Jack Smith		-10		10	-8635	8635	0	70,000		25		8635							
3	Total	Muffins	Stuff-Mart	BRA-12-11	\$11.62	7.1	0.111	A		Jack Smith		-10		10	-17440	17440	0	50,000		25		17440							
4	Total	Muffins	Stuff-Mart	BLU-12-11	\$22.52	7.1	0.111	A		Jack Smith		-10		10	-3608	3608	10,000	40,000		25		3608							
5	Total	Muffins	Stuff-Mart	APP-12-11	\$22.52	7.1	0.111	B		Jack Smith		-10		10	-1893	1893	4,000	12,000		25		1893							
6	Total	Muffins	Stuff-Mart	OAT-12-11	\$11.62	7.1	0.111	B		Jack Smith		-10		10	-13659	13659	0	50,000		25		13659							
7	Total	Muffins	Sids-Club	COR-12-11	\$11.62	7.1	0.111	B		Amy Brown		-10		10	-3765	3765	2,862	10,393		25		3765							
8	Total	Muffins	Sids-Club	BRA-12-11	\$11.62	7.1	0.111	B		Amy Brown		-10		10	-3438	3438	4,252	11,129		25		3438							
9	Total	Muffins	Sids-Club	BLU-12-11	\$22.52	7.1	0.111	B		Amy Brown		-10		10	-5101	5101	0	25,000		25		5101							
10	Total	Muffins	Sids-Club	APP-12-11	\$22.52	7.1	0.111	B		Amy Brown		-10		10	-9378	9378	0	35,000		25		9378							
11	Total	Muffins	Grocery-Land	COR-12-11	\$13.67	7.1	0.111	B		Bob White		-15		15	-2646	2646	4,000	12,000		35		2646							
12	Total	Muffins	Grocery-Land	BLU-12-11	\$23.67	7.1	0.111	C		Bob White		-15		15	-1873	1873	2,000	8,000		35		1873							
13	Total	Muffins	Grocery-Land	APP-12-11	\$23.67	7.1	0.111	B		Bob White		-15		15	-4320	4320	4,918	13,558		35		4320							
14	Total	Muffins	Food-King	COR-12-11	\$13.67	7.1	0.111	A		Bob White		-15		15	-12979	12979	0	36,000		35		12979							
15	Total	Muffins	Food-King	BLU-12-11	\$23.78	7.1	0.111	A		Bob White		-15		15	-11379	11379	5,899	28,658		35		11379							
16	Total	Muffins	Food-King	APP-12-11	\$23.78	7.1	0.111	A		Bob White		-15		15	-7266	7266	3,278	17,811		35		7266							
17	Total	Cakes	Stuff-Mart	VA-20-01	\$38.68	15.96	0.125	B		Jack Smith		-10		10	-5040	5040	0	15,000		25		5040							
18	Total	Cakes	Stuff-Mart	ST-20-02	\$38.68	15.96	0.125	E		Jack Smith		-10		10	-930	930	1,000	4,000		25		930							
19	Total	Cakes	Stuff-Mart	LF-20-02	\$38.68	15.96	0.125	C		Jack Smith		-10		10	-1367	1367	2,000	8,000		25		1367							
20	Total	Cakes	Stuff-Mart	LE-20-02	\$38.68	15.96	0.125	D		Jack Smith		-10		10	-992	992	2,000	4,000		25		992							
21	Total	Cakes	Stuff-Mart	CO-20-01	\$38.68	15.96	0.125	E		Jack Smith		-10		10	-1487	1487	429	3,376		25		1487							
22	Total	Cakes	Stuff-Mart	CH-20-01	\$53.68	15.96	0.125	A		Jack Smith		-10		10	-5600	5600	0	15,000		25		5600							
23	Total	Cakes	Stuff-Mart	CA-20-01	\$53.68	15.96	0.125	B		Jack Smith		-10		10	-5266	5266	0	15,000		25		5266							
24	Total	Cakes	Stuff-Mart	BU-20-02	\$38.68	15.96	0.125	C		Jack Smith		-10		10	-2278	2278	2,000	8,000		25		2278							
25	Total	Cakes	Sids-Club	VA-20-01	\$38.68	15.96	0.125	C		Mary Martin		-10		10	-3310	3310	4,000	10,000		25		3310							
26	Total	Cakes	Sids-Club	LF-20-02	\$38.68	15.96	0.125	B		Mary Martin		-10		10	-4290	4290	4,000	18,000		25		4290							
27	Total	Cakes	Sids-Club	CO-20-01	\$38.68	15.96	0.125	B		Mary Martin		-10		10	-5902	5902	5,000	15,000		25		5902							
28	Total	Cakes	Sids-Club	CH-20-01	\$53.68	15.96	0.125	C		Mary Martin		-10		10	-3184	3184	0	8,000		25		3184							
29	Total	Cakes	Sids-Club	CA-20-01	\$53.68	15.96	0.125	B		Mary Martin		-10		10	-2959	2959	5,075	10,993		25		2959							
30	Total	Cakes	Sids-Club	BU-20-02	\$38.68	15.96	0.125	A		Mary Martin		-10		10	-5482	5482	4,000	25,000		25		5482							
31	Total	Cakes	Grocery-Land	VA-20-01	\$38.88	15.96	0.125	D		Bob White		-15		15	-706	706	1,000	40,000		35		706							
32	Total	Cakes	Grocery-Land	LF-20-02	\$38.88	15.96	0.125	D		Bob White		-15		15	-614	614	2,000	4,000		35		614							
33	Total	Cakes	Grocery-Land	LE-20-02	\$38.88	15.96	0.125	D		Bob White		-15		15	-637	637	1,500	4,000		35		637							

The secondary file, table or query must include a record for every end item in the corresponding data file, table or query or you will receive an error message when you attempt to read it. Notice that the attribute fields are present. In our example, columns E through G contain conversion factors, columns H and I contain custom filter fields and the remaining columns contain item-specific exception report thresholds.

If you will be using a table or query to hold the secondary information, you'll want to examine the *123Bakery_Secondary* table in the file *123 Bakery.mdb*.

Itemid0	Itemid1	Itemid2	Description	ConfFactor
Total	Muffins	Stuff-Mart	COR-12-11 Dollars	11.62
Total	Muffins	Stuff-Mart	BRA-12-11 Dollars	11.62
Total	Muffins	Stuff-Mart	BLU-12-11 Dollars	22.52
Total	Muffins	Stuff-Mart	APP-12-11 Dollars	22.52
Total	Muffins	Stuff-Mart	OAT-12-11 Dollars	11.62
Total	Muffins	Sids-Club	COR-12-11 Dollars	11.62
Total	Muffins	Sids-Club	BRA-12-11 Dollars	11.62
Total	Muffins	Sids-Club	BLU-12-11 Dollars	22.52
Total	Muffins	Sids-Club	APP-12-11 Dollars	22.52
Total	Muffins	Grocery-Land	COR-12-11 Dollars	13.67
Total	Muffins	Grocery-Land	BLU-12-11 Dollars	23.67
Total	Muffins	Grocery-Land	APP-12-11 Dollars	23.67
Total	Muffins	Food-King	COR-12-11 Dollars	13.67
Total	Muffins	Food-King	BLU-12-11 Dollars	23.78
Total	Muffins	Food-King	APP-12-11 Dollars	23.78
Total	Cakes	Stuff-Mart	VA-20-01 Dollars	38.68
Total	Cakes	Stuff-Mart	ST-20-02 Dollars	38.68
Total	Cakes	Stuff-Mart	LF-20-02 Dollars	38.68
Total	Cakes	Stuff-Mart	LE-20-02 Dollars	38.68
Total	Cakes	Stuff-Mart	CO-20-01 Dollars	38.68
Total	Cakes	Stuff-Mart	CH-20-01 Dollars	53.68
Total	Cakes	Stuff-Mart	CA-20-01 Dollars	53.68
Total	Cakes	Stuff-Mart	BU-20-02 Dollars	38.68
Total	Cakes	Sids-Club	VA-20-01 Dollars	38.68
Total	Cakes	Sids-Club	LF-20-02 Dollars	38.68
Total	Cakes	Sids-Club	CO-20-01 Dollars	38.68
Total	Cakes	Sids-Club	CH-20-01 Dollars	53.68
Total	Cakes	Sids-Club	CA-20-01 Dollars	53.68
Total	Cakes	Sids-Club	BU-20-02 Dollars	38.68
Total	Cakes	Grocery-Land	VA-20-01 Dollars	38.88
Total	Cakes	Grocery-Land	LF-20-02 Dollars	38.88
Total	Cakes	Grocery-Land	LE-20-02 Dollars	38.88
Total	Cakes	Grocery-Land	CO-20-01 Dollars	38.88
Total	Cakes	Grocery-Land	CH-20-01 Dollars	55.88
Total	Cakes	Grocery-Land	CA-20-01 Dollars	55.88

Notice that the attribute fields are present. *Description* is a text field containing either the conversion factor's name or the item-specific exception report threshold's keyword (see below). *ConvFactor* is a number field with field size double containing either the conversion factor or the item-specific exception report threshold.

Conversion factors

The unit of measure used in the historic data file is used as the *default* unit of measure. Forecast Pro TRAC allows you to define item-level conversion factors (i.e., multipliers) which can be used to display the history and forecasts in alternative units (e.g., dollars, pounds, etc.).

You can name your conversion factors whatever you wish with two exceptions—they cannot begin with the word “filter” and you cannot use the exception report threshold names described below.

Custom filter fields

You can define custom filter fields in the secondary file. These fields can be included in the report views and filtered like any other fields. They can also be included in the numeric output file.

The custom filter field names must begin with the word “filter”. You can include filter values for both end items and groups.

Item-level exception report thresholds

Forecast Pro TRAC Exception Reports allow you to define either global or item-specific thresholds to flag exceptions. If you plan on using item-specific thresholds, you must define them in the secondary file.

You can include item-level thresholds for both end items and groups. When generating an Exception Report using item-level thresholds, if a given end item or group does not contain an item-level threshold it will not be flagged as an exception.

Each Exception Report has its own specific item-level thresholds field names. The chart below documents the conventions.

Field Name	Exception Report	Description
FVH_MINP	Forecasts vs. History	Defines item-level lower threshold for allowable percent deviation of forecast value from historic value.
FVH_MAXP	Forecasts vs. History	Defines item-level upper threshold for allowable percent deviation of forecast value from historic value.
FVH_MIN	Forecasts vs. History	Defines item-level lower threshold for allowable unit deviation of forecast value from historic value.
FVH_MAX	Forecasts vs. History	Defines item-level upper threshold for allowable unit deviation of forecast value from historic value.
FR_MIN	Forecast Range	Defines item-level forecast range allowable minimum.
FR_MAX	Forecast Range	Defines item-level forecast range allowable maximum.
MAPE_MAX	Fitted MAPE	Defines item-level allowable fitted MAD threshold.
MAD_MAX	Fitted MAD	Defines item-level allowable fitted MAPE threshold.
FVA_MINP	Forecasts vs. Archive	Defines item-level lower threshold for allowable percent deviation of current forecast value from archived forecast value.

FVA_MAXP	Forecasts vs. Archive	Defines item-level upper threshold for allowable percent deviation of current forecast value from archived forecast value.
FVA_MIN	Forecasts vs. Archive	Defines item-level lower threshold for allowable unit deviation of current forecast value from archived forecast value.
FVA_MAX	Forecasts vs. Archive	Defines item-level upper threshold for allowable unit deviation of current forecast value from archived forecast value.
AVA_MINP	Archive vs. Actual	Defines item-level lower threshold for allowable percent deviation of archived forecast value from actual.
AVA_MAXP	Archive vs. Actual	Defines item-level upper threshold for allowable percent deviation of archived forecast value from actual.
AVA_MIN	Archive vs. Actual	Defines item-level lower threshold for allowable unit deviation of archived forecast value from actual.
AVA_MAX	Archive vs. Actual	Defines item-level upper threshold for allowable unit deviation of archived forecast value from actual.
WF_FC_MIN	Waterfall	Defines item-level lower

		threshold for allowable average forecast.
WF_FC_MAX	Waterfall	Defines item-level upper threshold for allowable average forecast.
WF_ERR_MIN	Waterfall	Defines item-level lower threshold for allowable average forecast error.
WF_ERR_MAX	Waterfall	Defines item-level upper threshold for allowable average forecast error.
WF_MPE_MIN	Waterfall	Defines item-level lower threshold for allowable mean percent forecast error.
WF_MPE_MAX	Waterfall	Defines item-level upper threshold for allowable mean percent forecast error.
WF_MAPE_MAX	Waterfall	Defines threshold for allowable MAPE.
WF_MAD_MAX	Waterfall	Defines threshold for allowable MAD.

Chapter 2

Saving Your Work

Forecast Pro TRAC can save eight different types of output.

Forecast Projects allow you to save your forecasting session so that you can return later and pick up where you left off or to share the session with others. The forecast project saves the data, forecasts, overrides, Hot List, modifiers etc. as they currently exist in memory. If you update your input data files after saving a project, when you reopen the project you'll have the option of either generating new forecasts using the updated data or restoring the conditions present when the project was saved (i.e., not recalculating the forecasts using the new data).

Numeric Output Files can contain time series output such as history, forecasts, fitted values and confidence limits as well as statistical output such as the forecasting model specification and summary statistics. These files can be saved in text, spreadsheet, ODBC or XML formats. You can include output for either all items forecasted or just for the Hot List. Generally speaking, if you will be importing the forecasts into another application these are the files you will want to use.

Formatted Forecast Reports can be saved to Excel. You can save these reports for the currently displayed item, all items on the Hot List or all items forecasted. The Excel workbook will include a separate worksheet for each

item containing a graph (optional) and the on-screen Forecast Report. These reports are convenient if you wish to present the forecasts and/or models used to colleagues.

Tracking Reports can be saved to Excel. You can save these reports for the currently displayed item, all items on the Hot List or all items forecasted. The Excel workbook will include a separate worksheet for each item containing a graph (optional) and the on-screen Tracking Report. These reports are only available if the database includes at least one archived forecast for the given item.

The *Item Report* can be viewed on-screen and saved to Excel. This report can contain Pareto information, statistical output such as the forecasting model specification and summary statistics as well as time series output such as history, forecasts, fitted values and confidence limits.

The *Override Report* can be viewed on-screen and saved to Excel. This report lists items where overrides and/or comments have been made.

The *Exception Report* can be viewed on-screen and saved to Excel. This report lists all items that have been flagged as exceptions using the currently defined exception logic settings.

The *Outlier Report* can be viewed on-screen and saved to Excel. This reports lists items where outliers have been detected and/or corrected.

The following sections discuss these output files in more detail.

Forecast Projects

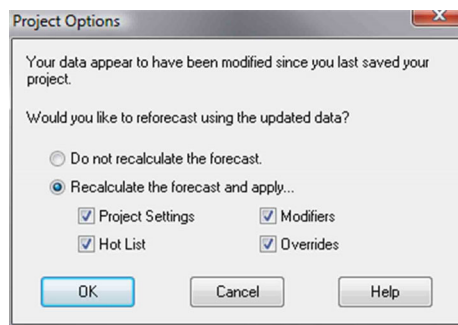
Forecast Projects allow you to save your forecasting session so that you can return later and pick up where you left off or to share the session with others. The forecast project saves the data, forecasts, overrides, Hot List, modifiers etc. as they currently exist in memory. If you update your input data files after saving a project, when you reopen the project you'll have the option of either generating new forecasts using the updated data or restoring the conditions present when the project was saved (i.e., not recalculating the forecasts using the new data).

Opening Projects

To save a forecast project you select **File>Save** or click the blue Save Project icon (📁). To open a forecast project you select **File>Open** or click the blue Open Project icon (📁).

If you open a project and data files have not changed (i.e., the time and date stamps match), the project will restore the conditions present when the project was saved allowing you to continue your work.

If you open a project and the data files are not available, the project will restore the conditions present when the project was saved—thus you can review projects, make adjustments, etc. even if you do not have access to the data files. This will often be the case when sharing projects with colleagues.



If you open a project and data files have changed, a dialog box will appear allowing you to either generate new forecasts using the updated data or restore the conditions present when the project was saved (i.e., do not recalculate the forecasts using the new data).

Project Files

The project consists of either three or four separate data files.

The Project Settings File (*.FPProj) is an XML file containing the project settings and script definition.

The TRAC Database File (*.db or *.TRAC) is either a SQLite or Microsoft Access database file that contains information pertaining to the current forecast period and all previously archived forecasts. The 64-bit version of

Forecast Pro TRAC will always use SQLite database files. The 32-bit version can use either SQLite or Microsoft Access, and you can specify which database file type to use on the Advanced tab of the Options dialog box. The setting can only be changed on a new project prior to reading in the data.

The Project Tables File (.mdb)* is a Microsoft Access database file containing separate tables for the in-place overrides/comments, forecast modifiers and Hot List. This file is only created when using Access database files.

The Project Snapshot File (.fcb)* is a binary file that saves the forecast components that are currently in memory (e.g., the forecasts, summary statistics, etc.) so that the session can be restored without having to read in the data, recalculate the forecasts, etc. This allows you to return to your session where you left off and to share the session with others.

When sharing projects with others, you need to provide all the project files.

Using Zipped Projects to Improve Performance

In some networked environments, working with projects stored on a network drive can be substantially slower than working on a project stored locally. To improve performance in these cases, Forecast Pro TRAC supports “zipped” projects. When you save a zipped project, Forecast Pro TRAC zips the project files described in the previous section into a single file with the extension .FPZip.

When you open a zipped project, Forecast Pro TRAC copies the zipped file from the network drive to a local workspace, unzips the project files and opens the project—allowing you to work on your project locally, even though it was saved to a network drive. When you resave your zipped project, Forecast Pro TRAC will zip the updated local project files and save the updated .FPZip file to the network drive.

To save and open zipped projects, you select FPZip as the file type in the **File>Save as** and **File>Open** dialog boxes.

Numeric Output Files

Numeric Output Files can contain time series output such as history, forecasts, fitted values and confidence limits as well as statistical output such as the forecasting model specification and summary statistics. These files can be saved in text, spreadsheet, ODBC or XML formats. You can include output for either all items forecasted or just for the Hot List. Generally speaking, if you will be importing the forecasts into another application these are the files you will want to use.

You can specify the format and content of Numeric Output File using **Settings>Numeric Output Design**. The operation of the Numeric Output Design dialog box is described in the Command Reference section of this manual.

You can preview the contents of the current Numeric Output File using the Numeric Output view. You can open this view using **View>Numeric Output** or using the yellow Preview Numeric Output icon ().

To save a Numeric Output file for all items forecasted, select **Project>Export>Full Numeric Output** or click the purple Save Numeric Output icon (.

To save a Numeric Output file for the current Hot List you select **Project>Export>Hot List Numeric Output** or use the **Save Numeric Output** option on the Hot List's context menu.

Formatted Forecast Reports

Formatted Forecast Reports can be saved to Excel. You can save these reports for the currently displayed item, all items on the Hot List or all items forecasted. The Excel workbook will include a separate worksheet for each item. These reports are convenient if you wish to present the forecasts and/or models used to colleagues.

Each report contains the information found in the current Forecast Report view and (optionally) the graph found in the current graph view.

You can specify the format and content of Formatted Forecast Report using **Settings>Forecast Report Design** and **Settings>Graph Settings**. The operation of the Forecast Report Design and Graph Settings dialog boxes are described in the Command Reference section of this manual.

To save a Forecast Report file for all items forecasted, you select **Project>Export>Full Forecast Report** or click the purple Save Formatted Forecast Report icon ().

To save a Forecast Report file for the current Hot List you select **Project>Export>Hot List Forecast Report** or use the **Save Forecast Reports** option on the Hot List's context menu.

You can print a forecast report for the currently displayed item using **File>Print**, the blue Print icon or the **Print this page** option on the Forecast Report view's context menu. You can also save an Excel report for the currently displayed item using the **Save this page to Excel** option on the Forecast Report view's context menu.

Tracking Reports

Tracking Reports can be saved to Excel. You can save these reports for the currently displayed item, all items on the Hot List or all items forecasted. The Excel workbook will include a separate worksheet for each item. These reports are only available if the database includes at least one archived forecast for the given item.

Each report contains the information found in the current Forecast Report view and (optionally) the graph found in the current graph view.

You can specify the format and content of Tracking Reports using **Settings>Tracking Report Settings**. The operation of the Tracking Report Settings dialog box is described in the Command Reference section of this manual.

To save a Tracking Report file for all items forecasted, select **Project>Export>Full Tracking Report** or click the purple Save Forecast Tracking Report icon.

To save a Forecast Report file for the current Hot List, select **Project>Export>Hot List Tracking Report** or use the **Save Tracking Report** option on the Hot List's context menu.

You can print a tracking report for the currently displayed item using **File>Print**, the blue Print icon or the *Print this page* option on the Tracking Report view's context menu. You can also save an Excel report for the currently displayed item using the **Save this page to Excel** option on the Tracking Report view's context menu.

Item Reports

Item Reports can be viewed on-screen and saved to Excel. These reports can contain Pareto information, statistical output such as the forecasting model specification and summary statistics as well as time series output such as history, forecasts, fitted values and confidence limits.

To open an Item Report you select **View>Item Report** or click the yellow View Item Report icon (). To save an Item Report you select **Project>Export>Item Report** or use the view's context menu.

You can specify the format and content of the report using **Settings>Item Report Design**. The operation of the Item Report Design dialog box is described in the Command Reference section of this manual.

Override Reports

Override Reports can be viewed on-screen and saved to Excel. These reports list the items where overrides and/or comments have been made.

To open an Override Report you select **View>Override Report** or click the yellow View Override Report icon (). To save an Override Report, select **Project>Export>Override Report** or use the view's context menu.

You can specify the format and content of the report using **Settings>Override Report Design**. The operation of the Override Report Design dialog box is described in the Command Reference section of this manual.

Exception Reports

Exception Reports can be viewed on-screen and saved to Excel. These reports list the items where your forecast error or some other performance metric has fallen outside of an acceptable range. Exception reporting reduces the need for manual review of your forecasts, and allows you to focus on the items where human attention is most needed.

To open an Exception Report you select **View>Exception Report** or click the yellow View Exception Report icon (). To save an Exception Report you select **Project>Export>Exception Report** or use the view's context menu.

Forecast Pro TRAC provides a wide array of exception reports, some of which monitor the current forecasts and others which monitor your archived forecasts. You can specify the format and content of the report using **Settings>Exception Report Settings**. The operation of the Exception Report Settings dialog box is described in the Command Reference section of this manual.

Outlier Reports

Outlier Reports can be viewed on-screen and saved to Excel. These reports list the items where outliers have been detected and/or corrected.

To open an Outlier Report you select **View>Outlier Report** or click the yellow View Outlier Report icon (). To save an Outlier Report you select **Project>Export>Outlier Report** or use the view's context menu.

The content and format of the report is controlled using the Outlier Report's context menu.

Chapter 3

Working with Scripts and Hierarchies

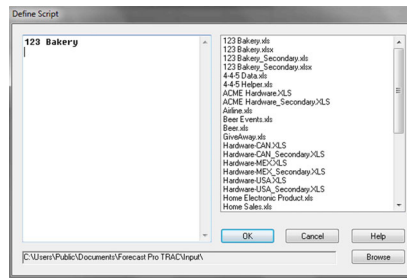
The script is a list of the data files to be forecasted. Together, the script and the data files define the hierarchy that will appear in the Navigator when you read the data into Forecast Pro TRAC.

This chapter explains how to define scripts and also discusses the strategies that Forecast Pro TRAC uses to produce consistent forecasts for hierarchical data.

Defining the Script

The information contained in the script is recorded in the current forecast project. In the case of a new forecast project, the script is initially blank. If you open an existing forecast project, the script is the same as when the project was saved.

The Define Script dialog box pictured below is accessed by clicking on the red Script icon () or by selecting **Operations>Script**.



The dialog box consists of the script area and the data list box. You can use the vertical scroll bar to see other lines of the script.

The data list box displays the currently available data files or ODBC tables. If you double-click a filename or table name in the box, the text is transferred to the currently selected script line.

Defining the Hierarchy

Product data can almost always be organized into several levels of aggregation. Suppose that an SKU (Stock Keeping Unit) consists of a size and color of a shoe in a certain style. These are the items of importance for production and inventory control. The corporation might aggregate these SKU's first into styles and then into style lines for marketing and sales. These might be aggregated further into geographical regions for the benefit of top management.

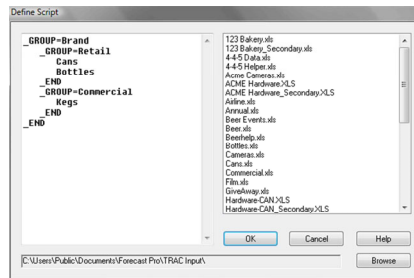
Forecast Pro TRAC allows you to define product hierarchies and create one set of self-consistent forecasts. It allows top-down or bottom-up reconciliation, seasonal adjustment based upon aggregate data and model selection at the aggregate level.

It is *not* necessary that item histories begin and end at the same time. Thus items may consist of SKU's that have been retired or replaced by new SKU's. Obsolete SKU's will contribute to the group level history but will not themselves be forecasted. You will notice that the starting and ending dates for the overall script consist of the starting date for the oldest item and the ending date for the newest. Forecasts will be prepared for all items and groups that are “alive” at the end of the data set. Those whose histories terminate before that time are considered dead—they contribute to the historic

aggregates (and therefore influence aggregate forecasts) but they are not themselves forecasted.

Forecast Pro TRAC allows you to organize your data into hierarchies two different ways. The most common approach is to define the groupings directly in the data file using attribute fields. This approach was discussed in the *Setting Up Your Data* chapter.

The other approach is to define the groups on your script. Here, for example, is a script that a beer manufacturer might use



This script defines three aggregate groups named Brand, Retail and Commercial. These group variables are not in the database—they are created internally by aggregating all data files found between a `_GROUP=` statement and its corresponding `_END` flag.

Thus, the group Retail is defined as the sum of all of the time series found in the data files Cans and Bottles. The group Commercial is defined as the sum of all of the time series found in the data file Kegs. The group Brand aggregates the two lower-level groups Retail and Commercial. Notice that each group definition begins with a `_GROUP=NAME` line and ends with an `_END`. The indentation is optional and serves only to make the script easier to read.

In addition to using the `_GROUP=` and `_END` modifiers on the script you can also define groups within a data file using attribute fields. Groups defined within files will appear on the Navigator when the data are read in. You can combine script-based and within-file group definitions if you wish.

Reconciling the Hierarchy

If no group-level reconciliation modifiers have been specified, a bottom-up approach will be used to reconcile the forecasts. The procedure operates as follows.

First Forecast Pro TRAC prepares forecasts for each and every group and item.

Then it recomputes the group-level forecasts by aggregating the constituent forecast (bottom up). The original group-level forecasts are replaced, but the width of their confidence limits are retained and re-centered on the new forecasts.

Two group-level modifiers can be used to specify alternative reconciliation approaches. These modifiers can only be used on group-level data.

\TOPDOWN directs Forecast Pro TRAC to perform top-down reconciliation for all members of the indicated group.

This procedure begins by preparing forecasts for each and every group and item.

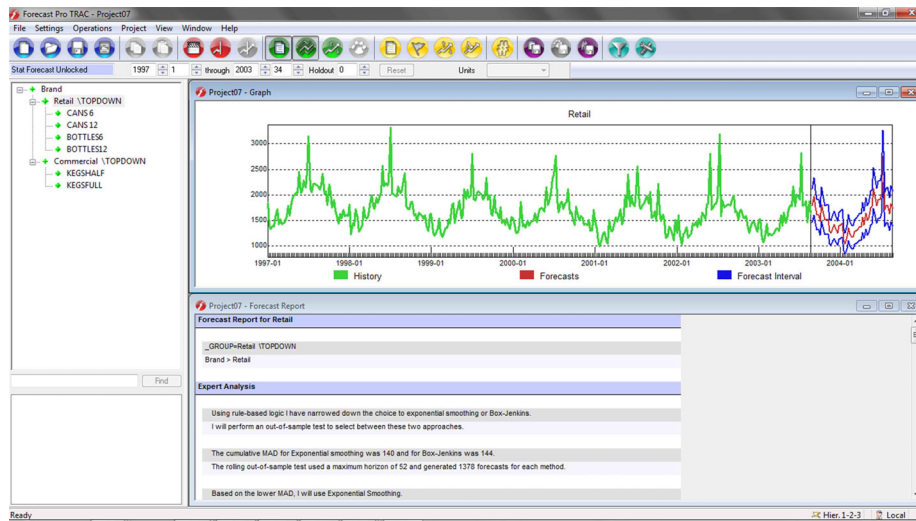
Then it proportionally adjusts the nested lower level items and groups forecasts to sum to the **\TOPDOWN** group forecast. If the **\TOPDOWN** group is itself nested within larger groups, the forecasts for the larger groups are computed by the bottom-up approach. (An example of top-down reconciliation is given below.)

You cannot define a **\TOPDOWN** group as a member of another **\TOPDOWN** group.

\INDEXES directs Forecast Pro TRAC to calculate the seasonal indexes at the indicated group level and use them to deseasonalize the histories for the nested items and groups. The deseasonalized series are then forecasted and as a final step reseasonalized. This approach works well when the items share the same seasonality. It allows one to deal with items whose histories are too short to extract seasonality directly. You cannot nest **\INDEXES** groups

within each other. Model parameters are reestimated for each item of the \INDEXES group.

The following screenshot illustrates the use of the \TOPDOWN modifier.



In the example above, \TOPDOWN directs Forecast Pro TRAC to compute forecasts and confidence limits for the aggregate groups Retail and Commercial at the aggregate level. The item level forecasts and confidence limits are multiplicatively adjusted so that the item level forecasts sum correctly to the group level forecasts. Forecasts for Brand are obtained by bottom-up aggregation of the groups Retail and Commercial.

Note the assumptions behind this approach. We have assumed that the nested items are statistically similar, so that we can obtain better forecasts of the groups Retail and Commercial by forecasting them as a unit. However, the forecast models for these two groups are judged as distinct compared to the irregularity. Thus the best forecasts of Brand are obtained by direct aggregation of the two member groups.

It would be illegal to add the modifier \TOPDOWN to the line defining BRAND unless we remove the \TOPDOWN modifiers from the two member groups. In this case the entire hierarchy would be reconciled using top-down aggregation. Usually, in a hierarchy involving three or more levels of aggregation, you will want to place the \TOPDOWN modifiers somewhere near the middle.

Two things happen as we move from item level data upwards through the hierarchy.

The effects of irregularity decrease through aggregation.

Statistical models become more complex and distinct from each other. Thus the signal-to-noise ratio increases as we move upwards through the hierarchy.

Now consider the case where both the \TOPDOWN and \INDEXES keywords are used for Retail and Commercial. In this case, Forecast Pro TRAC extracts seasonal indexes for these groups at the group level. It then deseasonalizes each item level history by using the indexes from the parent group, forecasts the resulting nonseasonal data, and then reseasonalizes the forecasts. The forecasts are then reconciled as already described.

A note about negative values

In a multiple-level problem, it is assumed that the data are basically nonnegative—the aggregate level data *must* be non-negative, but the item level data can include a few negatives.

Negative sales figures are relatively common since many companies register returns as negative sales. Furthermore, returns are often accumulated on the books and taken as occasional “hits” on sales. While this may make good accounting sense, it raises forecasting problems and will certainly decrease accuracy. Ideally, companies would either distribute returns to the months in which the products were shipped, or maintain returns as an entirely different historic record. Nevertheless, listing sales as negative is common and must be dealt with in some way.

Beyond an expected decrease in accuracy for forecasts from a product with negative sales, negatives pose a technical problem for product hierarchies. Multiplicative seasonal indexes cannot be extracted from a nonpositive series and additive indexes cannot be disaggregated to nested products. Thus, if the group level data contain negatives, Forecast Pro TRAC will use an additive index model and seasonal disaggregation will not be allowed (i.e., the \INDEXES flag will be ignored). In the case of positive group level data with negative values in the constituent data, the multiplicative adjustment of

negative values may have a different effect than one expects—a seasonal index of 1.5 to a sales figure -100 yields the value -150.

Top-down adjustment is also problematic when negative *forecast* values are involved. Therefore, Forecast Pro TRAC clips negative forecasts to zero if you have specified top-down disaggregation, regardless of how you have set *Allow negative forecasts* in the Options dialog box in the **Settings** menu.

Chapter 4

Using Forecast Modifiers

By default, Forecast Pro TRAC will automatically select a forecasting model for each item on the Navigator using expert selection. The expert selection option works extremely well and is the method of choice for the majority of Forecast Pro TRAC users. The expert selection algorithm is described in the *Forecast Pro Statistical Reference Manual*.

Alternatively you can dictate the models and/or forecasting options using *forecast modifiers*. Forecast modifiers are added to items on the Navigator using the Navigator's context menu.

This chapter documents the available modifiers. A complete listing of the available modifiers is also found in the on-line help system.

Model Specification Modifiers

Model specification modifiers are used to dictate that a specific model be used for the time series.

Supported modifiers are listed below grouped by model type.

Expert Selection

Model>Expert Selection (no modifier). If an item on the Navigator does not contain a modifier then Forecast Pro will use its expert selection algorithm to automatically select the appropriate forecasting method. If an item on the Navigator does contain one or more modifiers and you select *Model>Expert Selection* the modifiers will be removed and Forecast Pro will use its expert selection algorithm to automatically select the appropriate forecasting method.

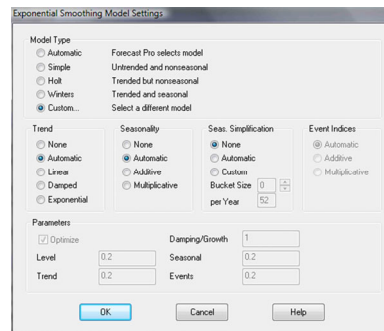
Exponential Smoothing

Model>Exponential Smoothing>Auto: \EXSM. Use the automatic fitting exponential smoothing model.

Model>Exponential Smoothing>Simple: \SIMPLE. Use the simple exponential smoothing model.

Model>Exponential Smoothing>Holt: \HOLT. Use the Holt exponential smoothing model.

Model>Exponential Smoothing>Winters: \WINTERS. Use the Winters exponential smoothing model.



Model>Exponential Smoothing>Custom: \EXSM=XY. Use a custom exponential smoothing model with trend type X (N=no trend, L=linear trend, D=damped trend, E=exponential, *=Forecast Pro decides), seasonality type Y (N=nonseasonal, M=multiplicative seasonal, A=additive seasonal, *=Forecast Pro decides) and optimized smoothing weights.

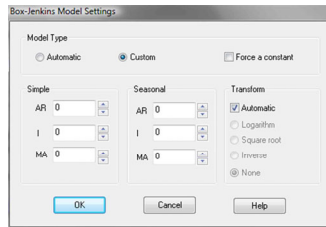
Model>Exponential Smoothing>Custom: $\backslash EXSM=XY(A,B,C,D)$. Use a custom exponential smoothing model with trend type X (N=no trend, L=linear trend, D=damped trend, E=exponential, *=Forecast Pro decides), seasonality type Y (N=nonseasonal, M=multiplicative seasonal, A=additive seasonal, *=Forecast Pro decides) and user defined smoothing weights (A=level, B=trend, C=damping/growth, D=seasonal).

Model>Exponential Smoothing>Custom: $\backslash SS$. Use Forecast Pro's automatic identification procedure to determine whether to use seasonal simplification and the appropriate bucket size.

Model>Exponential Smoothing>Custom: $\backslash SS=n$. Use seasonal simplification with bucket size equals n.

Box-Jenkins

Model>Box-Jenkins>Auto: $\backslash BJ$. Use the automatic fitting Box-Jenkins model.



Model>Box-Jenkins>Custom: $\backslash ARIMA(p,d,q)$. Use a non seasonal Box-Jenkins model with model orders p, d and q.

Model>Box-Jenkins>Custom: $\backslash ARIMA(p,d,q)*(P,D,Q)$. Use a seasonal Box-Jenkins model with model orders p, d, q, P, D and Q.

Model>Box-Jenkins>Custom: $\backslash CONST$. Include a constant intercept in the Box-Jenkins model.

Discrete Data

Model>Discrete: $\backslash DISCRETE$. Use a simple exponential smoothing model and base confidence limits on one of the discrete distributions (Poisson or

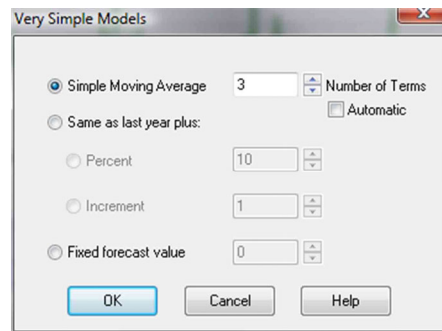
negative binomial). This option is used to obtain better estimates of the confidence limits for low volume integer series (typically with many zeros).

Intermittent Data

Model>Intermittent: \INTER. Use the Croston's intermittent data model.

Very Simple Models

Several of the menu options available under **Model>Very Simple Models** invoke the dialog box below.



Model>Very Simple Models>Simple Moving Average: \SMA= n . Use an n -term simple moving average. If the Automatic option is selected Forecast Pro TRAC will choose the number of terms to use and the forecast modifier will be displayed as \SMA.

Model>Very Simple Models>Same as Last Year>No Change: \SALY. Set each forecasted value to equal the value for the same period last year (either history or forecast as the case may be).

Model>Very Simple Models>Same as Last Year>Plus Percent: \SALYP= n . Set each forecasted value to equal the value for the same period last year plus the specified percentage (n).

Model>Very Simple Models>Same as Last Year>Plus Increment: \SALYI= n . Set each forecasted value to equal the value for the same period last year plus the specified increment (n).

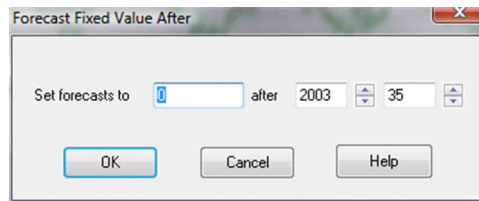
Model>Very Simple Models>Same as Last Year>Plus Delta Percent:

\SALYDP. Set each forecasted value to equal the value for the same period last year adjusted by the percentage change between the value for the same period last year and the same period two years ago.

Model>Very Simple Models>Same as Last Year>Plus Delta Increment:

\SALYDI. Set each forecasted value to equal the value for the same period last year adjusted by the unit change between the value for the same period last year and the same period two years ago.

Model>Very Simple Models>Fixed Forecast Value: \FIXED= n . Set each forecasted value to n .



Model>Very Simple Models>Fixed Forecast Value After:

\FIXEDAFT=(Year, Period, n). Set each forecasted value which falls after the year and period specified to n .

Curve Fitting

Models>Curve Fit>Automatic: \CFIT. Use the curve fitting routine that minimizes the BIC over the historic data.

Models>Curve Fit>Straight Line: \CFIT=LINE. Fit a straight line to the data set.

Models>Curve Fit>Quadratic: \CFIT=QUAD. Fit a quadratic curve to the data set.

Models>Curve Fit>Exponential: \CFIT=EXPO. Fit an exponential curve to the data set.

Models>Curve Fit>Growth Curve: \CFIT=GROW. Fit a growth curve to the data set.

Bass Diffusion

Model>Bass Diffusion: \BASS. Use the Bass diffusion model with automatically generated coefficients.

Model>Bass Diffusion: \BASS(*p,q,m*). Use the Bass diffusion model with user defined coefficients *p*, *q* and *m*.

By Analogy

Model>By Analogy: \ANALOG=*X*. Use the by analogy model with automatic calculation of the launch total. *_X* is the name of the time series containing the analogy series.

Model>By Analogy: \ANALOG=*X(A,B)*. Use the by analogy model with a specified launch total of *A*, and a specified launch horizon of *B*.

Model>By Analogy: \ANALOG=*X(A,B, C, D)*. Use the by analogy model with a specified launch total of *A*, a specified launch horizon of *B*, and a specified launch date with a starting year of *C* and starting date of *D*. This option is only available when the series being forecasted has no historic data.

Event Model Modifiers

To build an event model, you must tell the program when events of each type occur. To do this, you must construct an event schedule which classifies each period by event type (0=no event, 1=event of type 1, 2=event of type 2, etc.). The format is the same as that for any other historic data record, except that its entries are all small integers. The event schedule must be defined for each period in the historic record. If you want to forecast the effects of future known events, you must include these future periods as well.

The event schedule is a *helper variable*. Helper variables names *must* start or end with an underbar. Helper variables are not forecasted and their values are not included in group totals. Helper variables are used in conjunction with event models, weighting transformations and by analogy models.

For examples of constructing event variables and building event models, consult *Building Event Models* in the tutorial section. For more statistical

details, consult the section on exponential smoothing in the *Forecast Pro Statistical Reference Manual*.

The following modifiers are associated with event models.

Events>Select: \EVENT=_X. Use an event model. _X is the name of the time series containing the event schedule.

Model>Exponential Smoothing>Custom: \EXSM=XYZ. Use an exponential smoothing model with trend type X (N=no trend, L=linear trend, D=damped trend, E=exponential, *=Forecast Pro decides), seasonality type Y (N=nonseasonal, M=multiplicative seasonal, A=additive seasonal, *=Forecast Pro decides) and event type Z (M=multiplicative, A=additive, *=Forecast Pro decides). This modifier can only be used in conjunction with \EVENT=.

Model>Exponential Smoothing>Custom: \XYZ(A,B,C,D,E). Use an exponential smoothing model with trend type X (N=no trend, L=linear trend, D=damped trend, E=exponential, *=Forecast Pro decides), seasonality type Y (N=nonseasonal, M=multiplicative seasonal, A=additive seasonal, *=Forecast Pro decides), event type Z (M=multiplicative, A=additive, *=Forecast Pro decides) and user defined smoothing weights (A=level, B=trend, C=damping/growth, D=seasonal, E=event). This modifier can only be used in conjunction with \EVENT=.

The Weighting Transformation Modifier

The weighting transformation is most commonly used to deseasonalize your variables using externally supplied seasonal weights, or to normalize the data for trading day effects (e.g., 4-4-5 calendars, number of working days per month, etc.).

To use the weighting transformation you must create a *helper* variable containing the weights. Helper variables names *must* start or end with an underbar. Helper variables are not forecasted and their values are not included in group totals. Helper variables are used in conjunction with event models, by analogy models and weighting transformations.

The following modifier is used to specify the weighting transformation.

Weights>Select: \WGT=_X. Use an weighting transformation. _X is the name of the time series containing the weights.

The procedure divides each value of the specified time series by the corresponding value (weight) in _X. It then forecasts the deweighted variable and multiplies the forecasts by their corresponding weights. The weighting variable _X must span the entire history and forecast period for each variable to be forecasted.

Outlier Detection/Correction Modifiers

When you generate forecasts, Forecast Pro TRAC uses the current settings in the Outliers tab to determine the default behavior for detection and correction or outliers. There are three choices:

None. Do not detect nor correct for outliers.

Detection only. Detect and report outliers but do not correct for them (i.e., base the forecasts on the uncorrected values).

Detection and correction. Detect and correct outliers (i.e., base the forecasts on the corrected values).

You can override this project level-setting for individual items using the forecast modifiers listed below. Forecast Pro TRAC only detects outliers for end items (i.e., non-group level data), so the modifiers cannot be used for groups.

Outliers>Default: (*no modifier*). Revert back to the default project-level setting for the specified item. This option is used to remove any of the outlier modifiers (listed below) from the Navigator.

Outliers>Off: \OUTLIER=OFF. Do not detect nor correct outliers for the specified item.

Outliers>Detect: \OUTLIER=DETECT. Detect and report outliers for the specified item, but do not correct for them (i.e., base the forecasts on the uncorrected values).

Outliers>Correct: \OUTLIER=CORRECT. Detect and correct outliers for the specified item (i.e., base the forecasts on the corrected values).

Reconciliation Modifiers

If no group-level reconciliation modifiers have been specified, a bottom-up approach will be used to reconcile the forecasts. The procedure operates as follows.

First Forecast Pro TRAC prepares forecasts for each and every group and item.

Then it recomputes the group-level forecasts by aggregating the constituent forecast (bottom up). The original group level forecasts are replaced, but their confidence limits are retained and proportionately adjusted.

Two group-level modifiers can be used to specify alternative reconciliation approaches. These modifiers can only be used on group-level data.

Top down: \TOPDOWN. directs Forecast Pro TRAC to perform top-down reconciliation for all members of the indicated group.

This procedure begins by preparing forecasts for each and every group and item.

Then it proportionally adjusts the nested lower level items and groups forecasts to sum to the \TOPDOWN group forecast. If the \TOPDOWN group is itself nested within larger groups, the forecasts for the larger groups are computed using a bottom-up approach.

Indexes: \INDEXES. directs Forecast Pro TRAC to calculate the seasonal indexes at the indicated group level and use them to deseasonalize the histories for the nested items and groups. The deseasonalized series are then forecasted and as a final step reseasonalized. This approach works well when the items share the same seasonality. It allows one to deal with items whose histories are too short to extract seasonality directly. You cannot nest \INDEXES groups within each other. Model parameters are reestimated for each item of the \INDEXES group.

Miscellaneous Custom Modifiers

The modifiers listed below can be entered from the keyboard via **Custom Modifier** on the Navigator's context menu.

Custom Modifier: \LOWER= l . Set the lower confidence limit equal to the value l . l must be between 0.1 and 50.0 inclusive.

Custom Modifier: \UPPER= u . Set the upper confidence limit equal to the value u . u must be between 50.0 and 99.9 inclusive.

Custom Modifier: \CONF(l,u). Set the lower confidence limit equal to the value l and the upper confidence limit equal to u . l must be between 0.1 and 50.0 inclusive and u must be between 50.0 and 99.9 inclusive.

Custom Modifier: \LEADTIME= n . Set the lead time for the safety stock to n . The specified lead time appears highlighted in the Safety Stock section of the Forecast Report and determines the values written to the Numeric Output file. Fractional entries (e.g., 1.5) are permitted.

Custom Modifier: \TIMEFENCE= n . Set the length of the time fence for the specified item to n . Be aware that if you use the \TIMEFENCE modifier to create a time fence shorter than the global time fence, it will shorten the time fence for all associated parent groups of the item.

Custom Modifier: \POW= key . Use a Box-Cox power transformation. Key may equal LOG, SQRT, INVERSE or any decimal number from -1.0 to 1.0. If you enter \POW=AUTO, Forecast Pro TRAC will test your data and implement an appropriate Box-Cox transformation (or none at all). Consult the *Forecast Pro Statistical Reference Manual* for a discussion of the Box-Cox power transformations.

Chapter 5

Command Reference

This chapter presents a command overview, a description of the user interface, a detailed description of each menu command and instructions on how to drive the program from the command line.

Operations Overview

To prepare forecasts from Forecast Pro TRAC, you must follow the following procedure.

Prepare the database.

Specify the data format and output options. This is accomplished using the Settings menu. Options set by the user will apply to the current forecast document and can also be saved to the ForecastProTRAC.ini file and used as defaults for all future forecast documents using the “Set as Default” button. Thus, you need only set the options when you use Forecast Pro TRAC for the first time, or when you wish to change the current settings.

Create the script. The script is a list of the data files to be forecasted. It is created using the Define Script dialog box, which can be accessed from **Operations>Script** or via the red Script icon ().

Select **Operations>Read Data**. Forecast Pro TRAC will then read the data from disk into RAM and display the starting and ending dates for the forecast run on the dialog bar.

Select **Operations>Forecast**. The program will then execute the script to prepare the forecasts. The forecasts are retained in memory and support the following optional steps.

Select **View>Overrides** to adjust the forecasts and, if appropriate, reconcile them across multiple levels.

Select **View>Forecast Report** to obtain text reports about individual forecasts.

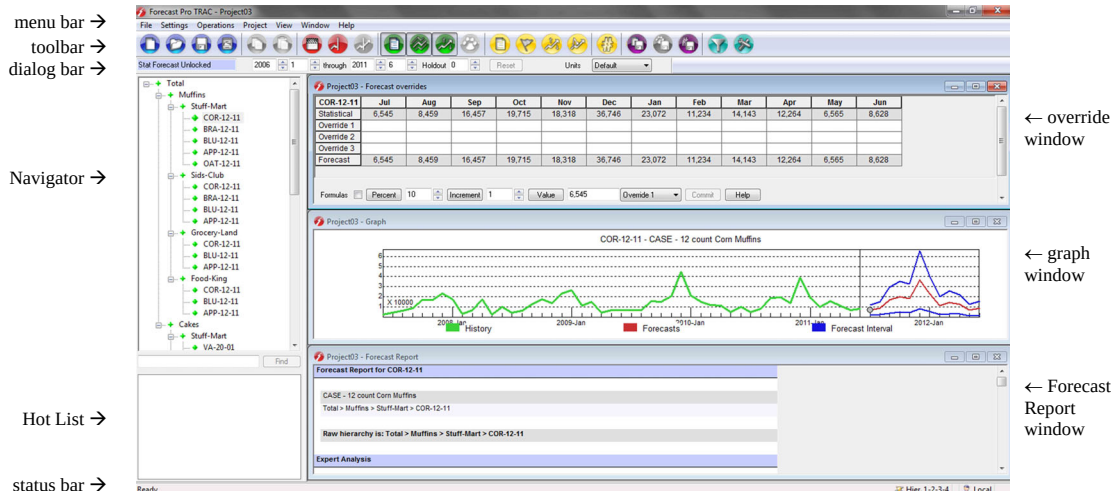
Select **View>Graph** to view the forecasts graphically.

Select **Project>Export>Full Numeric Output** to save them to disk or to your database via ODBC.

The remaining sections of this chapter document this procedure, as well as all other options, in more detail.

The Forecast Pro TRAC Interface

This section describes the Forecast Pro TRAC interface.



The Forecast Pro TRAC window consists of the following seven parts.

Menu bar

Toolbar

Dialog bar

Navigator

Hot List

9 view windows (three are shown above)

Status bar

The Menu bar

The menu provides access to all commands. A complete listing of all menu items and their associated dialog boxes is presented later in this chapter.

The Toolbar

The icons on the toolbar provide a quick access to the most commonly used commands. Here are the icons and their functions.



New Project. Closes the current forecast project allowing you to start a new one.



Open Project. Opens an existing forecast project.



Save Project. Saves the active forecast project.



Archive Forecasts. Writes the forecasts and other information to the Forecast Pro TRAC database. By default, Forecast Pro TRAC will automatically archive the forecasts when you save the project. This icon is usually used by individuals who have elected to turn of the “Archive forecasts automatically” option.



Copy. Copies the current selection to the Windows clipboard.



Paste. Inserts the contents of the Windows clipboard into the current insertion point.



Script. Accesses the Define Script dialog box allowing you to edit the current script.



Read Data. Reads in the data listed on the current script from its primary source.



Forecast. Executes the current script file and creates the forecasts. This option is only available when a script has been defined and the data have been read.



View Forecast Report. Opens and closes the Forecast Report view.



View Graph. Opens and closes the Graph view.



Override Forecasts. Opens and closes the Override view allowing you to adjust the forecasts for the current selection.



View Tracking Report and Graph. Opens and closes the Tracking Report view and Tracking Report Graph.



View Item Report. Opens and closes the Item Report view.



View Exception Report. Opens and closes the Exception Report view.



View Override Report. Opens and closes the Override Report view.



View Outlier Report. Opens and closes the Outlier Report view.



Preview Numeric Output. Opens and closes the Preview Numeric Output view. This view previews the contents and format of the Numeric Output file.



Save Formatted Forecast Report. Allows you to save Formatted Forecast Reports to disk. The Excel file will contain a report for every item forecasted. You can save Formatted Forecast Reports for the items on the current Hot List only using the Hot List's context menu.



Save Forecast Tracking Report. Allows you to save the Tracking Reports to disk. The Excel file will contain a report for every item for which at least one archived forecast is available. You can save Tracking Reports for the items on the current Hot List only using the Hot List's context menu.



Save Numeric Output. Allows you to save a Numeric Output file to disk. The file will contain output for every item forecasted. You can save a Numeric Output file for the items on the current Hot List only using the Hot List's context menu.



Apply Filters. Turns on and off report filtering mode. Filtering mode allows you to filter and sort the item, exception, override and outlier reports.



Options. Opens the Options dialog box allowing you to change the settings for the current forecast project.

The Dialog bar

The dialog bar is used to display the current script line, to set the span of the data, to define a holdout sample and to change the display units.

Defining the fit set. All time series methods begin by fitting the coefficients of a model to historic data. You can alter the beginning year and beginning

period to specify the first point of the fitting sample and/or the ending year and ending period to specify the last point.

The dialog bar automatically selects the largest fit set for which data exists. Normally, you will want to accept the defaults. However, you may want to ignore earlier data if you distrust their relevance.

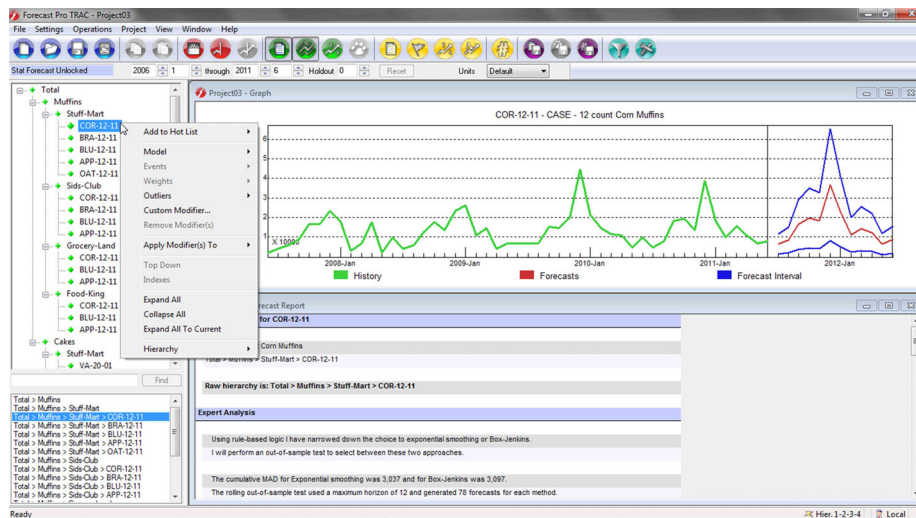
Defining a holdout sample. Edit the holdout sample box to specify a number of data points to be withheld from the end of your data set. If you withhold 2 or more points, Forecast Pro TRAC automatically generates out-of-sample evaluation statistics for any models that you build. If you do not want to perform out-of-sample testing, set the holdout sample to zero.

Changing Units. The Units drop down box is used to change the display units. This box will only be available if you have defined conversion factors for your current data set.

The Navigator

The Navigator is the primary way to select an item to view in the forecast report, graph and override windows. After the data have been read, the Navigator displays the available time series in a tree structure. Selecting an item on the Navigator will automatically display all relevant information in the open views.

The Navigator also features color-coded icons to allow you to spot items that contain overrides and/or comments. A red icon indicates that the item contains an override and/or comment. A green icon indicates that the item does not contain an override or comment. A yellow icon on a group indicates that at least one item further down that branch of the tree contains an override and/or comment.



The Navigator’s context menu provides a convenient way to build a Hot List, apply forecast modifiers, control the display of the Navigator tree and rearrange the hierarchy. Most of the options are self explanatory, however a few warrant some explanation.

The options under **Add to Hot List** are used to copy items onto the current Hot List (the Hot List is described in the next section). *Children*, *Parents* and *Siblings* refer to one level down on the current Navigator branch, one level up on the current branch and the same level on the current branch respectively. On the Analysis submenu, *Overrides* refer to items with direct overrides and *Affected* refers to items with indirect overrides (i.e., items where a direct override elsewhere in the hierarchy changed the item’s forecast).

The **Model**, **Events**, **Weights**, **Outliers**, **Top down** and **Indexes** options are all used to specify forecast modifiers. The most commonly used modifiers can be applied directly using the menu options. The less commonly used modifiers can be entered from the keyboard using the **Custom Modifier** option. A list of all supported modifiers and their function is found in the *Using Forecast Modifiers* chapter of this manual.

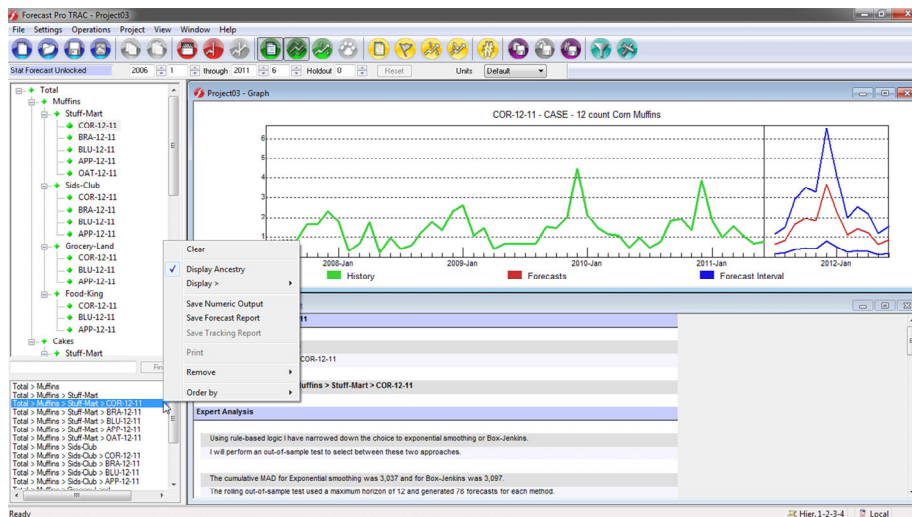
The **Hierarchy** option is used to “shuffle” (rearrange) the hierarchy displayed on the Navigator. Reading data into Forecast Pro TRAC establishes the default hierarchy. If the default hierarchy contains 4 levels, the notation 1-2-3-4 is used to represent the default state. **Hierarchy>Promote** and

Hierarchy>Demote redefine the hierarchy by moving the currently selected level “up” or “down” one level. For example, promoting level 3 of a 4-level default hierarchy, would change the displayed hierarchy from 1-2-3-4 to 1-2-4-3. **Hierarchy>Move to Top** promotes the currently selected level to the highest level, **Hierarchy>Move to Bottom** demotes the currently selected level to the lowest level and **Hierarchy>Restore Default** converts the currently displayed hierarchy back to the default hierarchy.

The Hot List

Placing items on the Hot List allows you to efficiently navigate, work with and report on a subset of the items listed on the Navigator. Items can be added to the current Hot List by dragging from the Navigator or by using the **Add to Hot List** option on the Navigator’s context menu.

When you select an item on the Hot List, Forecast Pro TRAC will immediately select the item on the Navigator and update the affected views.



The Hot List’s context menu allows you to change how items are displayed, save Numeric Output files, Forecast Report Files and Tracking Reports for the current Hot List items, and remove items from the Hot List.

View Windows

There are ten view windows available in Forecast Pro TRAC. Five of them, Forecast Report, Graph, Override Forecasts, Tracking Report and Tracking Graph, are context specific—meaning that the contents displayed in these windows will match the current Navigator selection and update automatically as you move about the Navigator. The context-specific views all have green icons.

The remaining four views, Item Report, Exception Report, Override Report, Outlier Report and Preview Numeric Output are global (i.e., their contents pertain to all items forecasted and are independent of the current Navigator selection). The global views all have yellow icons.

A description of each of the views appears below.

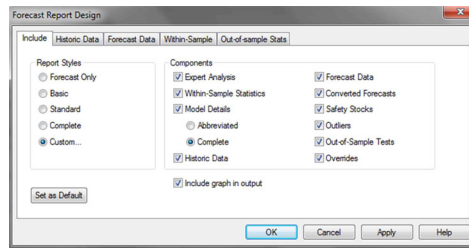
The Status bar

As you use Forecast Pro TRAC the status bar displays relevant information.

The Forecast Report View

The Forecast Report view is a scrollable text display containing information about the forecasts and how they were generated. In addition to providing a convenient way to view information while using Forecast Pro TRAC, the Forecast Report view is also used to design the text section of the formatted forecast reports that are output to Excel.

The Forecast Report Design dialog box allows you to customize the Forecast Report view. This dialog box is invoked by selecting **Settings>Forecast Report Design** or by selecting **Forecast Report Design** from the Forecast Report view's context menu.



You can either select one of the four standardized report styles or define a custom report. *Include graph in output* can be used in conjunction with any style report and specifies whether to include or omit a graph when saving a formatted forecast report to Excel. A description of each report style appears below.

Forecast Only is a minimal display consisting solely of the forecasts.

Basic displays a listing of the forecasting model used, a set of the most commonly used within-sample statistics, and a forecast display including confidence limits and summary statistics.

Standard is the default display. It includes the expert selection logic (if applicable), the model details including model coefficients, a full set of within-sample statistics, a listing of detected/corrected outliers (if outlier detection is active), a listing of any overrides and the same forecast display found in the Basic style.

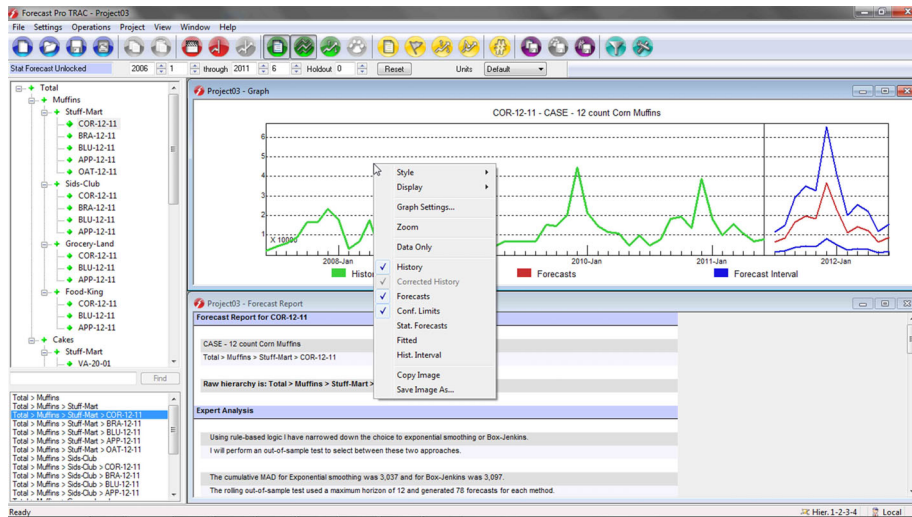
Complete displays everything found in the Standard display as well as a numeric listing of the historic values, fitted values, converted forecasts, safety stocks and an expanded forecast display.

Custom allows you complete control over what is included in the display. Your selections under the Custom option are automatically retained for the project allowing you to switch between the Custom style and one or more of the standard styles without having to reset your custom settings.

Important note: The Custom option allows you to set the numeric precision for the within-sample statistics. These precision settings are used for both Custom and standard report styles.

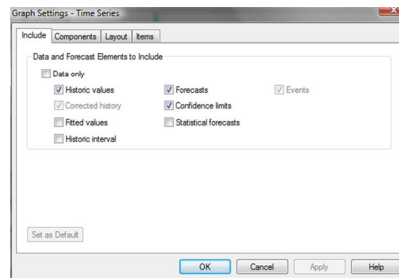
The Graph View

The graph view is used to display variables and forecasts graphically. In addition to providing a convenient way to view the forecasts while using Forecast Pro TRAC, the graph can also be included in the formatted forecast reports that you save to Excel. The format and content of the formatted forecast report's graph will match the current settings for the graph view.



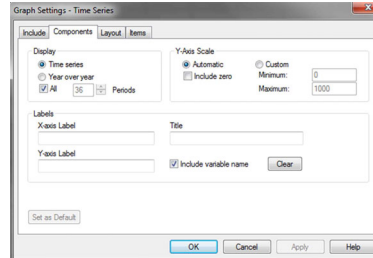
The Graph Settings dialog box allows you to customize the Graph view. This dialog box is invoked by selecting **Settings>Graph Settings** or by selecting **Graph Settings** from the Graph view's context menu.

The Settings dialog box contains four pages or tabs. We will discuss each in turn.



The Include tab allows you to select components to be displayed on the graph. The components can also be toggled on or off using the Graph view's context menu.

Selecting *Data only* toggles off all of the active components with the exception of the history.



The Components tab includes three sections.

The *Display* section allows you to select the graph type.

Time series displays a graph where the y-axis covers both the historic and forecast period. The *All* option will display the entire data set in a nonscrollable display. If the *All* option is not selected, the *Periods* option allows you to set how many periods should be included in a scrollable display.

Year over year displays a graph where the y-axis is one year long and the data for each year are “stacked” on the display. The *Years* option allows you to specify the number of years to include in the display.

Important note: Because the two graph types are fundamentally different, Forecast Pro TRAC maintains your settings for these graph types separately.

The *Labels* section allows you to define labels for the X and Y axis and add titles to the graph. The *include variable name* option will use the variable name followed by the description as the graph's subtitle. The Clear button erases the current labels.

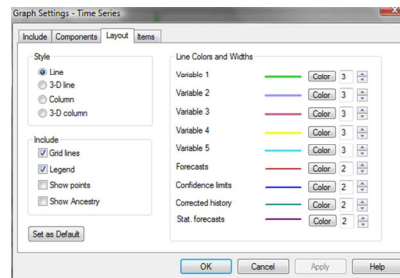
The *Y-Axis Scale* section controls the scaling.

Automatic allows Forecast Pro TRAC to select the Y-axis scale.

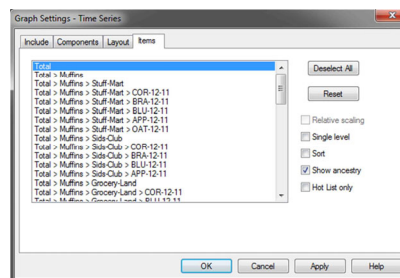
Custom lets you set the minimum and maximum for the Y-axis scale.

Include zero begins the y-axis at zero or at the minimum negative value.

Relative scaling is only relevant when you are graphing more than one variable. If it is on, each variable will be displayed on its own scale. If it is off, all variables will be displayed on the same scale. It is important to know whether relative scaling is on or off when you interpret the graph.



Most of the options in the Layout tab are self-explanatory. The *Style* section allows you to set the graph style. The *Line Colors and Widths* section allows you to specify the line colors and widths for the different variables and forecast components displayed. The *Include* section allows you to toggle on or off various components of the graph. If the *Show Ancestry* option is selected and the variable name is displayed on the graph, the variable name will appear preceded by any applicable parent group names.



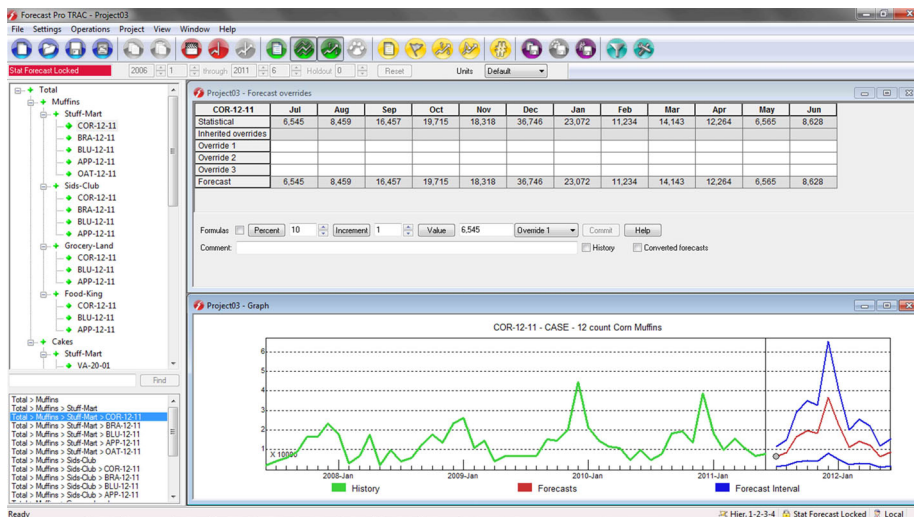
The Items tab allows you to choose up to five variables you want to graph.

The Override Forecasts View

The override view is used to enter overrides to the statistically generated forecasts. Changes made at any level of the forecasting hierarchy will automatically reconcile all levels. Refer to the *Understanding How Forecast Overrides are Allocated* chapter for a discussion on how the reconciliation is accomplished.

Up to ten override rows can be used and you can adjust the forecasts using percentages, increments or by typing in new values. You can also enter comments for any cell on the display.

There is an Overrides tab on the **Settings>Options** dialog box that allows you to control the document-level options, including how overrides should be applied (replacement values vs. incremental adjustments) and the precision of the display. This tab is fully documented in the *Menu Items and Dialog Boxes* section of this Command Reference chapter.



There are five rows in the example shown above.

Statistical contains the statistically based forecasts generated by Forecast Pro TRAC prior to any overrides being applied.

The *Inherited Overrides* row is only present if your project has changed states (i.e., you have either switched units of measure or have rearranged the hierarchy). When you change states it is not always possible to maintain the in-place overrides. This is due to factors such as the item or group that had an in-place override may no longer exist after you change the hierarchy or that changing the units would result in a different forecast allocation across the hierarchy.

To avoid these problems and to insure that the final forecasts will remain consistent regardless of the hierarchy or units you are viewing, Forecast Pro TRAC will move the in-place overrides into the Inherited Overrides row prior to performing hierarchy changes and/or conversions.

Override 1 and Override 2 contain any overrides that you have entered for the current forecasts. Proposed overrides are displayed in red, committed overrides are displayed in black. The Commit button is used to convert proposed overrides to committed overrides. The *Formula* checkbox allows you to enter overrides as either formulas or “hard numbers”. The override view’s context menu allows you to rename the override row labels and add or subtract rows on the fly.

Forecast contains the current committed forecasts. These are the values that are displayed on the graph, and the values that will be written as “forecasts” in any output files that you save to disk. The Forecast values may differ from the Statistical values if you have committed to overrides for the currently displayed forecasts *or any other forecasts in the hierarchy that would impact the currently displayed forecasts*.

There are three steps in the override process—selecting the point or points to override, entering the override(s) and committing to the override(s).

Points can be selected in the override window or in the graph window. The sum of the values for the points selected will be displayed in the *Value* edit box.

If you want to adjust the selected points by a certain percentage, enter the percentage in the *Percent* edit box and press the button. If you want to adjust each selected point by a certain increment, enter the increment in the *Increment* edit box and press the button. If you want to change the sum of the selected points to a defined value, enter the value in the *Value* edit box and

press the button. Adjustments made using the edit boxes will appear in the target override row specified to the left of the Commit button.

You can also enter overrides for a single point by typing a new value into one of the override row cells or by using the right mouse button to drag it to the desired new value on the graph.

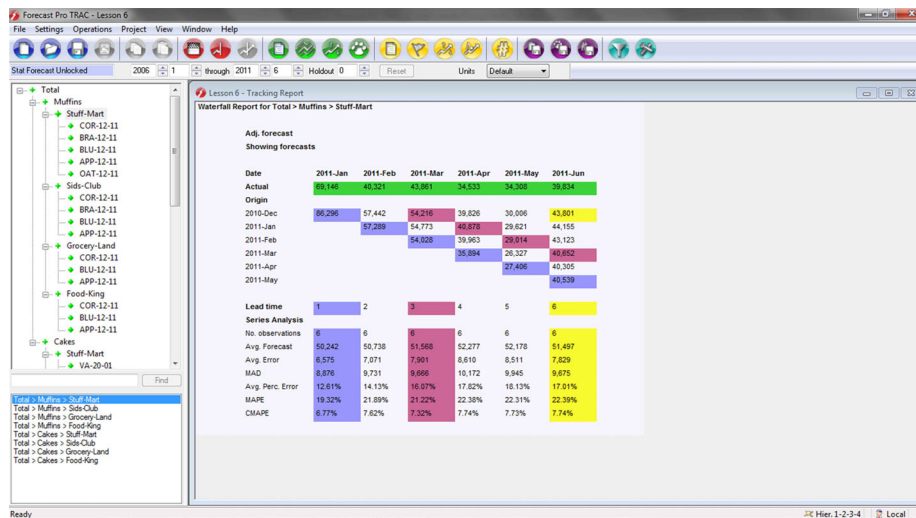
After you have entered the desired overrides and comments, click the Commit button to accept the changes and reconcile the hierarchy.

For large complex hierarchies the reconciliation can take a little time. To minimize the reconciliation time, Forecast Pro TRAC supports a manual override mode. When this mode is active, the override window will include a Retain button as well as a Commit Button. The Retain button is used to accept overrides without reconciling the hierarchy. In this mode you would typically enter and retain all of the overrides you wish to make (i.e., for multiple items) and then click Commit to perform the reconciliation. The control to turn on manual override mode is found on the Overrides tab of the **Settings>Options** dialog box.

The Tracking Report and Tracking Report Graph Views

The Tracking Report view and its associated Tracking Report Graph view allow you to compare previously generated forecasts with what actually happened. To view the Tracking Report your Forecast Pro TRAC database must contain archived forecasts.

To open the Tracking Report and Tracking Report Graph, click the green Tracking Report and Graph icon (). Alternatively, you can open the individual views using **View>Tracking Report** and **View>Tracking Report Graph**.



Due to its cascading-like appearance, the tracking report is sometimes referred to as a *waterfall* report. The report compares what we forecasted to what actually happened, therefore it is based on two key elements—the actual demand history and archived forecasts for the periods being analyzed.

In the example above, the actual demand history for the most current six months is shown in the first row with the green shading.

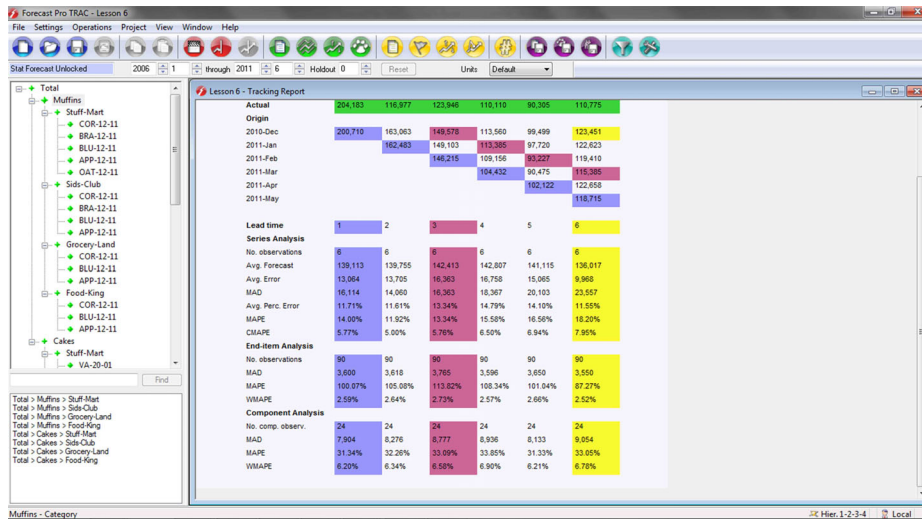
The next row down, displays the *Component Weight*. This displays the percentage that the demand represents of its parent group. Thus in our example, in January of 2011 *Total>Muffins>Stuff-Mart>Cor-12-11* composed 26.71 percent of the demand for its parent group, *Total>Muffins>Stuff-Mart*.

The next 6 rows display the forecasts generated for these periods from different forecast origins. Thus, the row labeled 2010-Dec displays the forecasts generated six months ago when the forecast origin was December 2010 and the first forecast period was January 2011. The row labeled 2011-May displays the forecast generated last month when the forecast origin was May 2011 and the first forecast period was June 2011.

The waterfall report allows you to color code *lead* times. A lead time refers to the number of periods ahead of the forecast origin the forecast was made for. Thus, a one-month-ahead forecast would have lead time equals 1, a two-month-ahead forecast would have lead time equals 2, etc.

In our example, the forecasts for lead time equals 1 are all shaded in blue, the forecasts for lead time equals 3 are all shaded in maroon, the forecasts for lead time equals 6 are all shaded in yellow. The color coding is used on both the tracking report and the tracking report graph. You can control the lead times to color code using the Tracking Report Settings dialog box.

The bottom portion of the report displays cumulative statistics for different lead times.



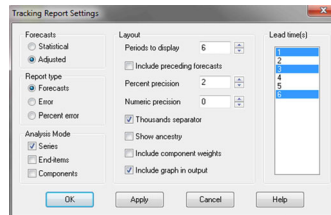
The cumulative statistics for different lead times portion of the report can include up to three sections—Series Analysis, End-item Analysis and Component Analysis. End-item Analysis and Component Analysis are only relevant to group-level data and are not displayed if an end-item is selected.

Series Analysis displays statistics for the currently selected time series. If the selection is a group, the statistics are based on the archived group-level forecasts. The CMAPE statistic found in this section is the Component MAPE. This is a weighted MAPE where the weighting factors are the component weights (see discussion above).

End-item Analysis displays statistics based on the archived forecasts for all end-items belonging to the currently selected group. The WMAPE statistic found in this section is a weighted MAPE where the weighting factors reflect the end item's volume. The weights are calculated by dividing each end item's volume by the group's volume.

Component Analysis displays statistics based on the archived forecasts for all component children (i.e., groups and/or end items one level lower in the hierarchy belonging to the currently selected group). The WMAPE statistic found in this section is a weighted MAPE where the weighting factors reflect the component children's volume. The weights are calculated by dividing each component child's volume by the group's volume.

The content and format of the Tracking Report is controlled using the Tracking Report Settings dialog box. This dialog box is invoked by selecting **Settings>Tracking Report Settings** or by selecting **Tracking Report Settings** from the Tracking Report view's context menu.



The *Forecasts* section allows you to display either the statistical or adjusted forecasts.

The *Report type* section allows you to display either the forecasts, the forecast error or the percent forecast error.

The *Analysis Mode* section allows you to specify which cumulative lead time statistic displays to include.

Most of the items in the *Layout* section are self-explanatory, however, we will comment on a couple of them. The “Periods to display” controls the number of lead times to include in the report. The “Include preceding forecasts” option displays all archived forecasts that go into the cumulative statistics rather than just the subset in the triangular display.

The *Lead time(s)* box allows you to specify up to four lead times to color code. The selected color coding is used on both the numeric and graphical displays.

The Item Report View

The item report can contain Pareto information, statistical output such as the forecasting model specification and summary statistics as well as time series output such as history, forecasts, fitted values and confidence limits.

To open the Item Report view, select **View>Item Report** or click the yellow View Item Report icon ().

If you double click an item on the Item Report, the Navigator will jump directly to that item. Thus, you can use the Item Report as the equivalent of a Hot List to navigate through the listed items. All of the global report views (yellow icon views) support this kind of navigation.

The content and format of the report is controlled using the Item Report Design dialog box. This dialog box is invoked by selecting **Settings>Item Report Design** or by selecting **Item Report Design** from the Item Report view's context menu.

The Exception Report View

The Exception Report view enables you to quickly find cases where your forecast error or some other performance metric has fallen outside of an acceptable range. Exception reporting reduces the need for manual review of your forecasts, and allows you to focus on the items where human attention is most needed.

Forecast Pro TRAC provides a wide array of exception reports, some of which monitor the current forecasts and others which monitor your archived forecasts.

To open the Exception Report view, select **View>Exception Report** or click the yellow Exception Report icon (.

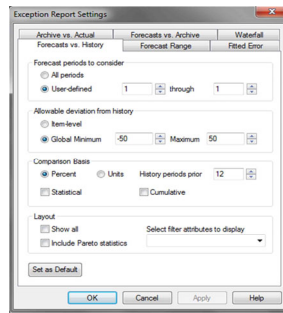
Total	Category	Customer	SKU	Lower Bound	Upper Bound	Date	Forecast	Prior Period(12)	Deviation	% Deviation	Stat. Forecast	Deviation	% Deviation
Total	Muffins	Side-Club	COR-12-11	-50.00%	50.00%	2011-Jul	7,050	3,836	3,214	63.79%	7,050	3,214	63.79%
Total	Muffins	Food-King	NULL	-50.00%	50.00%	2011-Jul	36,606	22,796	13,810	60.58%	36,606	13,810	60.58%
Total	Muffins	Food-King	APP-12-11	-50.00%	50.00%	2011-Jul	16,285	10,504	5,781	55.04%	16,285	5,781	55.04%
Total	Cakes	Stuff-Mart	VA-20-01	-50.00%	50.00%	2011-Jul	10,352	8,860	4,472	76.59%	10,352	4,472	76.59%
Total	Cakes	Stuff-Mart	CH-20-01	-50.00%	50.00%	2011-Jul	13,503	7,560	5,943	78.61%	13,503	5,943	78.61%
Total	Cakes	Stuff-Mart	CA-20-01	-50.00%	50.00%	2011-Jul	14,197	9,345	4,967	63.64%	14,197	4,967	63.64%
Total	Cakes	Side-Club	BU-20-02	-50.00%	50.00%	2011-Jul	13,337	8,731	4,606	52.75%	13,337	4,606	52.75%
Total	Cakes	Food-King	VA-20-01	-50.00%	50.00%	2011-Jul	8,560	5,140	3,420	66.53%	8,560	3,420	66.53%
Total	Cakes	Food-King	CA-20-01	-50.00%	50.00%	2011-Jul	6,185	4,066	2,120	52.14%	6,185	2,120	52.14%

All exception reports are displayed in a format similar to the example shown above. A row is included for each exception found. The initial columns identify the flagged item. This is followed by either one or two columns displaying the thresholds that trigger an exception. This is followed by a Date column identifying the exception period. The next two columns display the value being monitored and what it is being monitored against. This is followed by a Deviation column showing the difference and the %Deviation column showing the difference as a percent.

Double clicking an item on an exception report will cause the Navigator to jump directly to that item. Thus, you can use the exception report as the equivalent of a Hot List to navigate through the listed items. All of the global report views (yellow icon views) support this kind of navigation.

The content and format of the Exception Report is controlled using the Exception Report Settings dialog box. This dialog box is invoked by selecting **Settings>Exception Report Settings** or by selecting **Exception Report Settings** from the Exception Report view's context menu.

There are six exception report types, each of which has a tab on the Exception Report Settings dialog box.



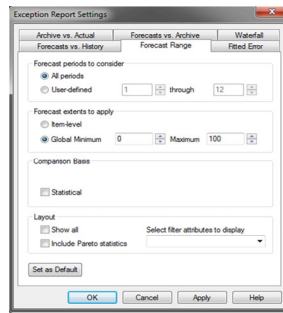
The Forecasts vs. History report compares the current forecasts to previous historic values.

The *Forecast periods to consider* section allows you to set the number of forecast periods to monitor.

The *Allowable deviation from history* section allows you to set the sensitivity of the exception thresholds. Item-level thresholds allow you to assign different sensitivities to different items. The item-level thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual. Global thresholds use the same thresholds for all items.

The *Comparison basis* section allows you to set whether you want the thresholds to use percentages or units, to set which historic point to compare the forecast with, to base the comparison on either the final forecast (which potentially includes user adjustments) or the statistical forecast and to use either individual forecast points or the cumulative total for the specified range. For example, the settings shown above which include a “History periods prior” setting of 12, will compare the forecast with the historic period 12 months prior (i.e., the same period last year).

The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined).



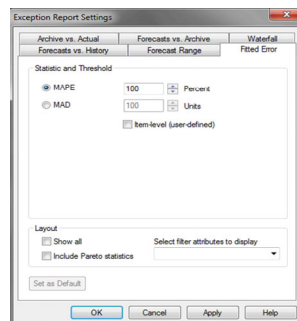
The Forecast Range report compares the forecast to defined upper and lower bounds and flags any forecasts that fall outside of the defined range.

The *Forecast periods to consider* section allows you to set the number of forecast periods to monitor.

The *Forecast extents to apply* section allows to define the ranges. “Item-level” allows you to define different ranges to different items. The item-level ranges must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual. Setting Global Minimum and Maximum values defines the range for all items.

The *Comparison basis* section allows you to base the comparison on either the final forecast (which potentially includes user adjustments) or the statistical forecast.

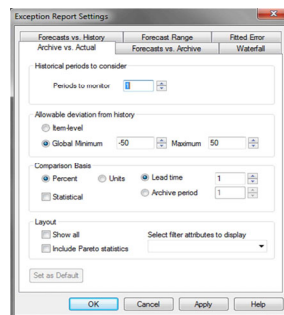
The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones outside of the range), to include columns for the Pareto output and to include columns for custom filters (if there are any defined).



The Fitted Error report will flag as an exception any forecast model where the within-sample MAPE or MAD exceeds the defined threshold.

The *Statistic and Threshold* section allows you to indicate whether you wish to monitor the MAPE or the MAD, to set a global threshold to use or to specify that item-level thresholds be used. If you select the Item-level option, the thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual.

The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined). When using the *Show all* option the report will display the MAPE and the MAD rather than just the specified threshold statistic.



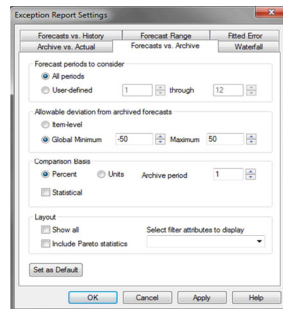
The Archive vs. Actual report compares an archived forecast (i.e., a forecast you prepared in the past) to what actually happened.

The *Historical periods to consider* section allows you select how many historic periods to monitor. Setting “Periods to monitor” to 1 will monitor the most recent historic value only. Setting “Periods to monitor” to 2 will monitor the most recent historic value and the period prior, etc.

The *Allowable deviation from history* section allows you to set the sensitivity of the exception thresholds. Item-level thresholds allow you to assign different sensitivities to different items. The item-level thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual. Global thresholds use the same thresholds for all items.

The *Comparison basis* section allows you to set whether you want the thresholds to use percent or units, to specify a lead time or archive period to use and to base the comparison on either the final forecast (which potentially includes user adjustments) or the statistical forecast. The “Lead time” and “Archive period” settings are only relevant if you are monitoring more than one historic point. They allow you to compare each historic point being monitored to either the corresponding forecast for a specific lead time or to forecasts made at a specific archive period (i.e., forecast origin).

The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined).



The Forecasts vs. Archive report compares the current forecast to an archived forecast for the same period and flags any cases where the change exceeds the thresholds.

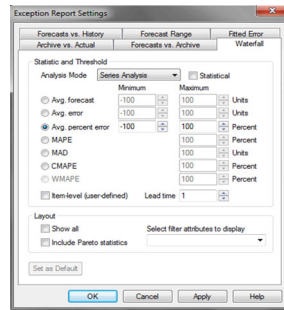
The *Forecast periods to consider* section allows you to set the number of forecast periods to monitor.

The *Allowable deviation from archived forecasts* section allows you to set the sensitivity of the exception thresholds. Item-level thresholds allow you to assign different sensitivities to different items. The item-level thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual. Global thresholds use the same thresholds for all items.

The *Comparison basis* section allows you to set whether you want the thresholds to use percent or units, to specify an archive period (i.e., forecast

origin) to use and to base the comparison on either the final forecast (which potentially includes user adjustments) or the statistical forecast.

The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined).



The Waterfall report compares the cumulative statistics for the specified lead time from the current waterfall report to the specified thresholds.

The *Analysis Mode* drop-down box allows you to specify which set of cumulative statistics to report.

Checking *Statistical* will base the comparison on the statistical forecast rather than the final forecast (which potentially includes user adjustments).

The other options in the *Statistic and Threshold* section allow you to specify the lead time to monitor, the statistic to use and set the thresholds.

If you select the Item-level option, the thresholds must be defined in the secondary file and must follow specific naming conventions. The details are found in the *Setting Up Your Data* section of this manual.

The *Layout* section allows you to show all items on the Navigator on the report (rather than only the ones that exceed the thresholds), to include columns for the Pareto output and to include columns for custom filters (if there are any defined). When using the *Show all* option the report will display all statistics included in the selected Analysis Mode rather than just the specified threshold statistic.

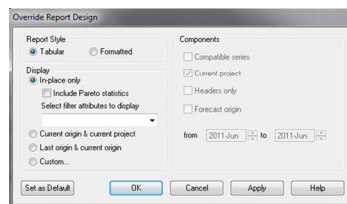
The Override Report View

The Override Report view lists items where overrides and/or comments have been made. The display is useful when reviewing the current overrides and also when loading archived override sets.

To open the Override Report view, select **View>Override Report** or click the yellow View Override Report icon (🔑).

If you double click an item on the Override Report, the Navigator will jump directly to that item. Thus, you can use the Override Report as the equivalent of a Hot List to navigate through the listed items. All of the global report views (yellow icon views) support this kind of navigation.

The content and format of the report is controlled using the Override Report Design dialog box. This dialog box is invoked by selecting **Settings>Override Report Design** or by selecting **Override Report Design** from the Override Report view's context menu.



The Display section allows you to control the override sets that will be displayed, to include columns for the Pareto output and to include columns for custom filters (if there are any defined).

In-place only restricts the display to the current in-place override set only. Thus, override sets made in previous states (e.g., in other units and/or hierarchies) will be omitted, as will override sets made for other origins (e.g., previous forecast periods) and override sets associated with other linked projects.

Current origin & current project displays all override sets for the current project and current origin (forecast period). Thus, override sets made in other states (e.g., in other units and/or hierarchies) will be included, however, override sets associated with different forecast origins (e.g., previous forecast

periods) and override sets associated with other linked projects will be omitted.

Last origin & current origin displays all override sets for the current and immediately previous origin (forecast period). This is often a useful display to view when you have updated the statistical forecasts and are loading override sets from the last forecast period via **Project>Import>Archived Overrides**.

Custom provides complete control over the override sets displayed. *Compatible series* restricts the display to override sets where the state (i.e., units of measure and hierarchy) match the current state. *Headers only* displays the one-line header for each override set, omitting the item-level override information. The *Forecast origin* option allows you to specify the range of origins to display.

The Outlier Report View

The outlier report view lists items where outliers have been detected and/or corrected. To open the outlier report view, select **View>Outlier Report** or click the yellow View Outlier Report icon (.

The content and format of the report is controlled using the outlier report's context menu. The context menu also allows you to print the currently displayed report and save it to Excel.

The Outliers tab of the **Settings>Options** dialog box includes an *Include iteration statistics in reports* option. If this option is active the outlier report will include detailed statistics describing the outlier detection. Consult the *Forecast Pro Statistical Reference Manual* for details.

The Numeric Output View

The Numeric Output view displays the contents and format of the currently specified Numeric Output file. When designing the Numeric Output file, it is useful to have the Numeric Output view open.

The Numeric Output Design dialog box contains both a Set as Default button and an OK button. Clicking the OK button will save your current settings for use with the current project. Clicking the Set as Default button will save your current settings for use with the current project and also save them as the default settings for all new projects.

Forecast file prefix. Specify the character(s) to use as the default prefix when naming the Numeric Output file. If the *Single Output file* option is selected in the Layout section, the default Numeric Output filename will be the prefix followed by the project name followed by “Numeric Output”. If the *Single Output file* option is not selected, each output filename will be the prefix followed by the corresponding input filename.

The Numeric Output View 213

defined in the input data source). If this option is not selected, the Numeric Output file save the forecasts and other components using the units of measure currently selected in Forecast Pro TRAC.

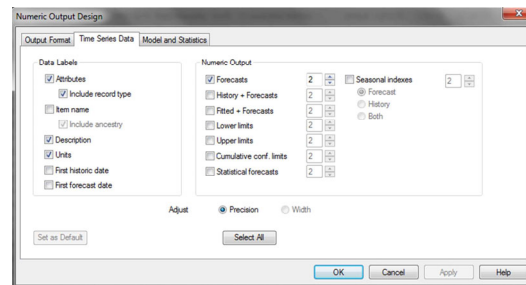
Default hierarchy only. If this option is selected, the Numeric Output file will save the forecasts and other components using the default hierarchy (i.e., the hierarchy defined in the input data source). If this option is not selected, the Numeric Output file will save the forecasts and other components using the hierarchy currently selected in Forecast Pro TRAC.

The Layout section of this tab allows you to specify the default data mode, the orientation (row vs. column), whether or not to include group level output and whether or not to include item-level data.

Single output file. Output a single Numeric Output file containing information for all forecasted items will be written. If *Single output file* is not selected, then a separate Numeric Output file will be written for each input file.

Break record up into lines. If selected, then each Numeric Output component specified on the Time Series Data tab (see below) will appear on a separate line of the Numeric Output file.

The Text Format section of this tab allows you to specify the conventions to use when outputting a text file. You will only be able to edit these settings when the data mode is set to Txt (text) or Mlt (text input file format).



The Time Series Data tab is used to define the data label fields, to select the forecast components to include and to set their precision. If you are outputting a fixed width text file then you may also set the column widths.

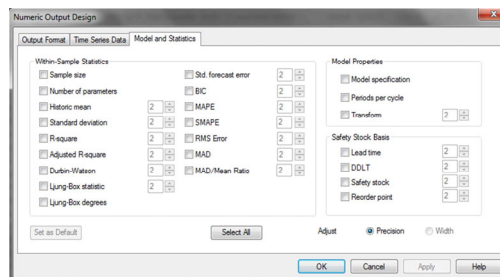
Attributes. Include separate attribute fields for each level of the hierarchy. If you used attribute fields in your input data files to define groups then you will most likely want to select this option so that your output file will match your input file. Consult the *Setting Up Your Data* chapter for a discussion of attribute fields.

Include record type. Include a record type field that identifies which forecast component is being output. This is useful if you use the *Break record up into lines* option and are outputting more than one numeric output component.

Item Name. Include a field listing the “name” of the variable as it appears on the Navigator. If the *Include ancestry* option is active the ancestry will be shown as part of the item name. The variable names used for all numeric output components other than “Forecasts” will include a suffix indicating the record type.

Description, Units, First historic date and First forecast date. Include fields for the selected options.

The Numeric Output section of the tab allows you to select the Numeric Output components you would like to include.



The Model and Statistics tab is used to define the within-sample statistics and model details that you wish to include and to set their precision. If you are outputting a fixed width text file then you may also set the column widths.

Most of the options are self explanatory. However, we have noted some details below.

Model specification. The model specification is a concise description of the model used. The notation that is used here is also used on the Forecast Report. Consult the *Forecast Pro Statistical Reference Manual* for further details.

Transform. The Box-Cox transformation power. 1 indicates no transform, .5 the square root and 0 the natural log.

Menu Items and Dialog Boxes

This section covers all of the Forecast Pro TRAC menu items and their associated dialog boxes.

The File Menu

The file menu is used to manipulate forecast project files, save ODBC connections strings for use in command-line operation, print the currently displayed forecast report and to exit Forecast Pro TRAC.

File>New is used to open a new forecast project. This task can also be accomplished using the blue New Project icon ().

File>Open is used to open an existing forecast project. This task can also be accomplished using the blue Open Project icon ().

File>Close is used to close the current forecast project.

File>Save is used to save the current forecast project using the currently specified name. This task can also be accomplished using the blue Save Project icon ().

File>Save as is used to save and name the current forecast project.

File>Print is used to print the currently selected view.

File>Print Preview is used to display the currently selected view formatted as it will be printed (see **File>Print** above). Checking the appearance of the output prior to printing can save you trips to the printer.

File>Print Setup is used to change various printing options.

File>Exit is used to exit Forecast Pro TRAC.

The Settings Menu

The settings menu provides access to the Options dialog box which allows you to change your project settings and to other dialog boxes which allow you to customize the various Forecast Pro TRAC views.

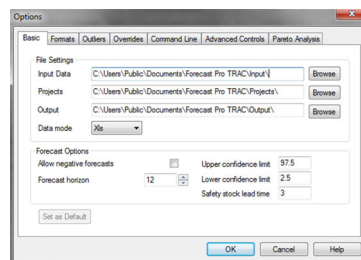
With the exception of **Settings>Options** which is described below, all of the other menu options lead to dialog boxes that are described in detail in the *Forecast Pro TRAC Interface* chapter.

Settings>Options

Selecting **Settings>Options** opens the Options dialog box which is used to change various Forecast Pro TRAC settings.

The Settings dialog box contains both a Set as Default button and an OK button. Clicking the OK button will save your current settings for use with the current project. Clicking the Set as Default button will save your current settings for use with the current project and also save them as the default settings for all new projects.

The Settings dialog box contains seven pages or tabs. We will discuss each in turn.



The Basic tab contains frequently accessed settings that every user should understand.

Input Data. Specify the complete path name of the directory where the program should read data.

Projects. Specify the complete path name of the directory where the program should write the project files.

Output. Specify the complete path name of the directory where the program should write all output files (e.g., Numeric Output files, forecast reports, etc.).

Data mode. Select the type of data file that you will be using from the list of supported types.

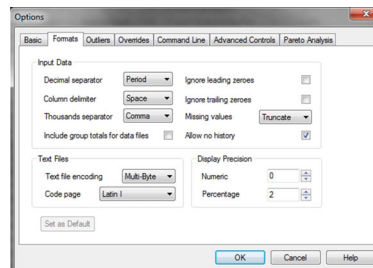
Allow negative forecasts. Most business data are inherently positive, although there are exceptions like telephone connection gain or sales data that include returns as negatives. Users with positive data are understandably disturbed when their forecasts turn negative. This can occur when Forecast Pro TRAC captures a downward trend at the end of your historic data. If *Allow negative forecasts* is turned off, Forecast Pro TRAC will clip forecasts to zero that would otherwise be negative. If *Allow negative forecasts* is turned on, then Forecast Pro TRAC takes no special actions to avoid negative forecasts.

Forecast horizon. Specify how many periods ahead you want Forecast Pro TRAC to forecast.

Upper confidence limit. Specify the percentile for the upper confidence limits. The upper confidence limit for a specific item can also be specified using the \Upper= modifier.

Lower confidence limit. Specify the percentile for lower confidence limits. The lower confidence limit for a specific item can also be specified using the \Lower= modifier.

Safety stock lead time. Specify the lead time for the safety stocks. The specified lead time appears highlighted in the Safety Stock section of the Forecast Report and determines the values written to the Numeric Output file. Fractional entries (e.g., 1.5) are permitted.



The Formats tab controls the formatting of the input and output.

Decimal separator. Specify whether a period or a comma is used for the decimal point. The program's default is the convention appropriate for the United States, which is the period.

Column delimiter. Specify whether items in an MLT file are separated by spaces, commas or tabs (i.e., are the files space delimited, comma delimited or tab delimited).

Thousands separator. Specify the thousands separator used for input MLT files. The choices are none, comma and period. Forecast Pro TRAC does not use thousand separators in output.

Ignore leading zeros. If this option is selected then leading zeros prior to the first nonzero data point will be ignored (i.e., the data has not started yet and the zeros are interpreted as placeholders). For a more complete discussion on the handling of missing data and the distinction between a zero value and a missing value, please refer to the Missing Values and Zeros section in the *Setting Up Your Data* chapter.

Ignore trailing zeros. If this option is selected then trailing zeros after the last nonzero data point will be ignored (i.e., the data has ended and the zeros are interpreted as placeholders). This means that the time series would be considered “dead” in multiple-level scripts and not forecasted. In nonmultiple-level scripts the forecasts for the time series would begin after the last nonzero point. For a more complete discussion on the handling of missing data and the distinction between a zero value and a missing value, please refer to the Missing Values and Zeros section in the *Setting Up Your Data* chapter.

Missing Values. Specify how you wish the program to treat missing values. The options are: truncate the data set (i.e. discard all data that precedes the missing value); impute the missing data or set missing data points to zero. Regardless of how this option is set, missing values that appear prior to the first data point are ignored. For a more complete discussion on the handling of missing data and the distinction between a zero value and a missing value, please refer to the Missing Values and Zeros section in the chapter entitled *Setting Up Your Data*.

Allow no history. If this switch is on, Forecast Pro TRAC will create a forecast of zero per period for items that have no historic data. If the switch is off, items with no historic demand will be omitted and not appear on the Navigator.

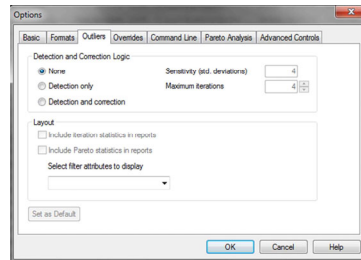
Include group totals for data files. If this switch is on, Forecast Pro TRAC will automatically include a group total for each data file listed on the script. Including or not including a group total for the data files will yield different hierarchies on the Navigator.

Text file encoding. Specify the format to use when writing two-byte characters to text files. This option is only of relevance if your data or scripts utilize non-ASCII characters. (Non-Latin based languages such as Japanese, Chinese, Russian, Arabic, etc. use non-ASCII characters.)

Code page. Specify the Windows code page to use when text file encoding is set to multi-byte. The code page specifies the character set to use when writing a multi-byte text file. (Most code pages are designed to support a specific language.)

Display Precision: Numeric. Specify the precision (i.e., number of decimal places) to use when displaying time series data in the view windows.

Display Precision: Percentage. Specify the precision (i.e., number of decimal places) to use when displaying percentages in the view windows.



The Outliers tab is used to specify whether or not to detect and/or correct outliers. It also allows you to set the sensitivity settings for outlier detection and to dictate the amount of detail in the outlier report.

None turns outlier detection off. The forecasts will be generated using the uncorrected history.

Detection only will detect outliers and display the suggested corrected values, however, the forecasts will be generated using the uncorrected history.

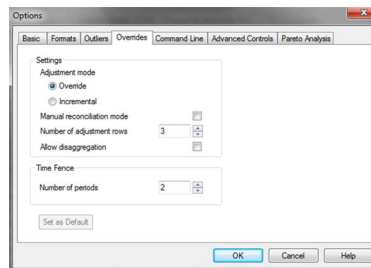
Detection and correction will detect outliers and will automatically use the corrected values when generating forecasts.

Sensitivity (std deviations) allows you to set the sensitivity of the outlier detection algorithm. If a given fitted error exceeds this threshold and it is the largest error detected during the current iteration it will be flagged as an outlier. Consult the *Forecast Pro Statistical Reference Manual* for details on how outlier detection and correction works.

Maximum iterations allows you to set the maximum number of iterations permitted during outlier detection for a given item. This setting thereby also defines the maximum number of outliers than can be detected for a given item. Consult the *Forecast Pro Statistical Reference Manual* for details on how outlier detection and correction works.

Include iteration statistics in reports allows you to include detailed statistics describing the outlier detection process in the outlier report. Consult the *Forecast Pro Statistical Reference Manual* for details.

The other options in the *Layout* section allow you to include columns for the Pareto output and to include columns for custom filters (if there are any defined).



The Overrides tab controls operation and display of the Override view.

Adjustment mode. If this selection is set to “Override” any overrides entered will replace the corresponding statistical forecasts (or overrides entered on a preceding row). If this switch is set to “Incremental” overrides you enter will be *added* as incremental adjustments to the statistical forecast rather than replacing it. Thus the final forecast will equal the sum of the statistical forecast and all overrides entered. If you attempt to change this setting when overrides exist for the current project, you will receive a warning and all overrides will be erased.

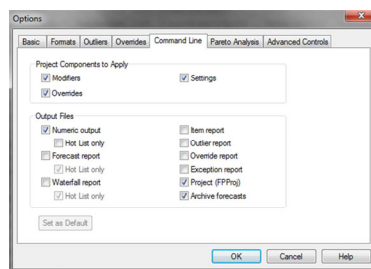
Manual reconciliation mode. If this switch is on, the override window will include a Retain button as well as a Commit button. The Retain button is used to accept overrides without reconciling the hierarchy. This is useful when working with large complex hierarchies where the reconciliation process takes some time.

In manual reconciliation mode you would typically enter and retain all of the overrides you wish to make (i.e., for multiple items) and then click the Commit button to perform the reconciliation once, rather than having to wait for the program to reconcile after each item that you override.

Number of adjustment rows. This setting controls the number of adjustment rows displayed in the Override view.

Allow disaggregation. If this switch is on, the Override window will include a “Disaggregate to” drop down box, allowing you to disaggregate (i.e., push down) any overrides made at a group level to a lower-level of the hierarchy. The disaggregation is based on a proportional allocation.

Number of periods. This option allows you to set the default length for the time fence. This setting can be overridden on an item-by-item basis using the \TIMEFENCE= modifier.



Forecast Pro TRAC supports command-line operation allowing you to create forecasts in a “hands-off” mode. For a complete description of how to run the product from the command line consult the *Operating From the Command Line* lesson in the tutorial and the *Command-line Operation* section of this chapter.

The Command Line tab allows you to dictate the options to apply if the current project is run via the command line.

The first three options control how the forecasts are generated when the project is run from the command line.

Modifiers. If this option is selected, the project’s forecast modifiers (if any are present) will be used to generate the forecasts in command-line mode. If this option is not selected, all forecast modifiers in the project will be ignored when running from the command line.

Overrides. If this option is selected, the command-line run will begin by reading in the data, generating the statistical forecasts and then it will apply any matching overrides/comments in the project to the new forecasts. If this option is not selected, all overrides in the project will be ignored when running from the command line.

Settings. If this option is selected, the command-line run will use all of the settings associated with the project (e.g., all settings in the Settings dialog box, numeric output formatting, etc.). If this option is not selected, the default settings (i.e., the settings that have been saved as the defaults for use with new projects) will be used when running from the command line. Project settings are saved in the project file (*.FPProj). Default settings are stored in the ForecastProTRAC.ini file.

The remaining options specify the output files to generate when the project is run from the command line.

Numeric output. If this option is selected, the command-line run will save the numeric output. You have the option of saving this file for all items forecasted or (if you select *Hot List only*) just for the items listed on the Hot List.

Forecast Report. If this option is selected, the command-line run will save a formatted forecast report file to Excel. You have the option of saving this file

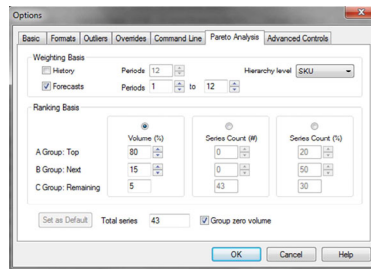
for all items forecasted or (if you select *Hot List only*) just for the items listed on the Hot List. Keep in mind that these files can potentially be *very large*.

Waterfall Report. If this option is selected, the command-line run will save a forecast tracking report file to Excel. You have the option of saving this file for all items forecasted or (if you select *Hot List only*) just for the items listed on the Hot List. Keep in mind that these files can potentially be *very large*.

Item report, Outlier report, Override report, and Exception report. If any of these options are selected, the command-line run will save the specified report(s). The format and contents (including all items vs. Hot List only) will match the current settings in the project (or the defaults if you've specified to use them).

Project (FPProj). If this option is selected, the command-line run will update and save new project files. Normally the only part of the project that will change during the command-line run is the binary file (*.fcb). This is a "snapshot" file that allows you to open up the project without reading in the data and generating new forecasts.

Archive forecasts. If this option is selected, the command-line run will update and save the TRAC database file. You should select this option if you are archiving forecasts for tracking purposes.



The Pareto Analysis tab allows you to specify how the ABC codes should be assigned.

History and Forecasts. These settings allows you to indicate whether the ranking should be performed using the historic demand or the current forecasts and allows you to set the span for your selection.

Hierarchy level. The ABC codes are assigned to a single level of the hierarchy. The Hierarchy level drop down allows you to pick the level to use.

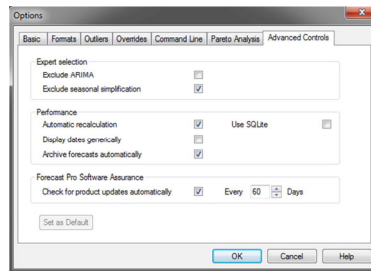
The Ranking Basis section allows you to set the thresholds for the classifications.

Volume (%). This option allows you to set the codes based upon the cumulative volume of each group. For example, if A is set to 80%, B is set to 15% and C is set to 5%, Forecast Pro TRAC will first rank all of the items from highest volume to lowest volume and then sequentially place the top ranked items into the A group until their cumulative volume equals or exceeds 80% of the total volume. It will then sequentially place items into the B group until the cumulative volume of the A and B items equals or exceeds 95% (80% + 15%). The remaining items (5% or less of the cumulative volume) are assigned type C.

Series Count (#). This option allows you to assign specific numbers of items to each group. For example, if you had 1,000 items and you set the A group to 100, the B group to 200 and the C group to 700—the 100 highest volume items would be assigned to group A, the next highest 200 items would be assigned to group B and the remaining 700 would be assigned to group C.

Series Count (%). This option allows you to assign a specified percentage of the total number of items you have to each group. For example if A is set to 20%, B is set to 50% and C is set to 30%, Forecast Pro TRAC will first rank all of the items from highest volume to lowest volume and then sequentially place the top ranked items into the A group until the number of A group items equals 20% of the total number of items. It will then sequentially place items into the B group until the number of B group items equals 50% of the total number of items. The remaining items (30% of the total number of series) are assigned type C.

Group zero volume. If this option is on, then any items having zero volume will be placed into group “D”.



The Advanced Controls tab allows you to set expert selection options, control the timing of some program operations and adjust how frequently Forecast Pro TRAC checks for program updates. Adjusting the expert selection and performance options can improve processing speed for forecasting, applying forecast modifiers and saving projects.

Exclude ARIMA. If this switch is on Forecast Pro TRAC’s expert selection mode will not consider Box-Jenkins models. This will speed the forecast generation process considerably.

Exclude seasonal simplification. If this switch is on Forecast Pro TRAC’s expert selection mode will not consider seasonally simplified forms of exponential smoothing models. If you are forecasting data where the number of periods per cycle is greater than 13 (e.g., weekly data) this will speed the forecast generation process considerably.

Automatic recalculation. If this option is selected, Forecast Pro TRAC will automatically recalculate the forecast and re-reconcile the hierarchy every time you apply a forecast modifier. For large hierarchies this can be time consuming. If you turn this option off, when you specify a forecast modifier the forecasts will not be updated until you click the red Forecast icon. This allows you to specify multiple forecast modifiers without having to wait for the program to recalculate the forecasts in between each specification.

Display dates generically. If this option is selected then monthly labels will be displayed using period numbers rather than the names of the months. For example, “2007-01” will be used rather than “2007-Jan”. This option is often used when working with a fiscal calendar where displaying the names of the months could be confusing.

Archive forecasts automatically. If this option is selected, Forecast Pro TRAC will automatically save all changes to the TRAC database every time you save your forecast project. For large hierarchies this can be time consuming. If you turn this option off, saving your projects will be much *quicker*, however, if you want to archive your forecasts for tracking purposes you will need to do so explicitly using **Operations>Archive forecasts** or the blue Archive Forecasts icon ().

Use SQLite. If this option is selected, Forecast Pro TRAC will save the project's database file as a SQLite file with the extension db. If you are running the 64-bit version of Forecast Pro TRAC this option will always be selected and greyed out on the dialog box (i.e., you can't change it).

If you are running the 32-bit version of Forecast Pro TRAC and this option is not selected, Forecast Pro TRAC will save the project's database file as a Microsoft Access file with the extension TRAC. The setting can only be changed on a new project prior to reading in the data. You can change the default for new projects, by setting this option and then selecting the Default button. If you are using the 32-bit version of Forecast Pro TRAC, you can also convert existing projects that use Microsoft Access to ones that will use SQLite using the menu option **Operations>Convert to SQLite**.

Check for product updates automatically. If this option is selected, Forecast Pro TRAC will periodically check online for product updates and alert you if they are available. If your support and maintenance contract is up to date, product updates are free.

The Operations Menu

The operations menu is used to perform basic program operations. Most of the actions can also be performed via icons.

Operations>ODBC Connect

Operations>ODBC Connect is used to connect to an ODBC database. After selecting this option you will be prompted for the type of database and the database file. This option is only available when the data mode is set to ODBC.

Operations>Script

Operations>Script accesses the Define Script dialog box allowing you to edit the current script. This dialog box can also be accessed via the red Script icon () . Please read the chapter entitled *Defining the Script* for complete details on the script.

Operations>Read Data

Operations>Read Data reads in the data listed on the current script from its primary source. This task can also be accomplished using the red Read Data icon () .

Operations>Forecast

Operations>Forecast executes the current script file and creates the forecasts. This option is only available when a script has been defined and the data has been read in. This task can also be accomplished using the red Script icon () .

Operations>Initialize Archive

Operations>Initialize Archive is used to generate statistical forecasts for previous forecast periods and to insert them into the Forecast Pro TRAC database. Essentially this is a form of simulation that allows you to initialize the forecast archive with statistical forecasts.



When you select **Operations>Initialize Archive** the Initialize Archive dialog box appears allowing you to specify how many periods you wish to initialize. Forecasts will be generated for the specified period and all subsequent periods up to the current origin.

In the example above, the periods to initialize is set to 12, which corresponds with a forecast origin of June 2008. Thus, the initialization would begin by generating forecasts using data up to and including June 2008 and inserting

them into the database. It would then generate forecasts using data up to and including July 2008 and insert them into the database. It would continue this process until all 12 forecasts sets had been generated and inserted into the database.

Operations>Archive Forecasts

Operations>Archive Forecasts writes the forecasts and other information to the Forecast Pro TRAC database. By default, Forecast Pro TRAC will automatically archive the forecasts when you save the project. This option is usually used by individuals who have elected to turn off the “Archive forecasts automatically” option. This task can also be accomplished using the blue Archive Forecasts icon ().

Operations>Time Fence>Enable

Operations>Time Fence>Enable turns on the time fence for the current project. Once you turn a project’s time fence on, *it cannot be turned off!*

Operations>Time Fence>Freeze Next Period

Operations>Time Fence>Freeze Next Period will increase the length of all time fences in the current project by one period for the current forecast origin. If you subsequently, update your data with the next observation and create a new forecast (thus changing the forecast origin) the time fence lengths will revert back to their pre-Freeze-Next-Period settings. This option provides a way of insuring that after the forecasts are finalized someone doesn’t inadvertently alter the frozen periods’ forecasts prior to the data being updated, new forecasts being generated and the frozen periods’ forecast becoming an officially fenced value.

Operations>Convert to SQLite

Operations>Convert to SQLite is only available in the 32-bit version of Forecast Pro TRAC. It is used to convert a Forecast Pro TRAC project that was saved using a Microsoft Access database file into a Forecast Pro TRAC project that uses a SQLite database file. This option is usually used when one is upgrading from the 32-bit version of Forecast Pro TRAC (which allows the

database file to be either Microsoft Access or SQLite) to the 64-bit version of Forecast Pro TRAC (which only supports SQLite) and wishes to convert their existing projects so they can be read into the 64-bit version.

When you convert projects, we recommend that you save your converted projects using a different project name so that you will still have a copy of the old project.

The Project Menu

The project menu is used to import overrides and modifiers from other projects, to export (i.e., save to disk) Numeric Output files and report files, to set project passwords, to create and open team archives and to perform database maintenance.

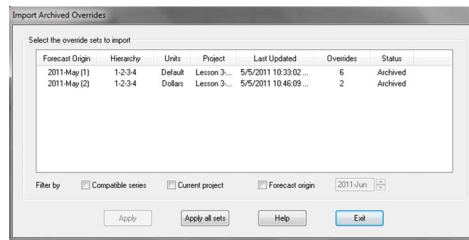
Project>Import

Project>Import>Overrides from is used to import overrides and their associated comments from a saved project into the current project. In order for a value to be imported, the item name, ancestry and date all need to match an item in the current project.

Project>Import>Modifiers from is used to import forecast modifiers from a saved project into the current project. In order for a modifier to be imported the item name and ancestry must match an item in the current project.

Project>Import>Archived Overrides is used to load override sets from the current Forecast Pro TRAC database. Common uses for this facility include loading override sets made last period after updating the statistical forecasts and loading override sets made in a team archive into a linked project.

In order for an override from the selected override set to be loaded, the item name and ancestry must match an item in the current project. When you select **Project>Import>Archived Overrides** the Import Archived Overrides dialog box appears.



The Import Archived Overrides dialog box allows you to select the override sets to load. You can load an individual override set by highlighting the set and clicking the Apply button. Alternatively, you can load all displayed sets using the “Apply all sets” button. The “Filter by” options allow you to control which override sets to display. Selecting “Compatible series” will eliminate all override sets that do not match the current state (i.e., it will eliminate all override sets where the units of measure and/or the hierarchy structure does not match the current project’s display).

Project>Export

The **Project>Export** menu allows you to save Numeric Output files and all Forecast Pro TRAC report files. Consult the appropriate section of the *Forecast Pro TRAC Interface* chapter for details on designing the content and format of these output files.

Project>Set password

Project>Set password is used to password protect your project. When you attempt to open a password-protected project, Forecast Pro TRAC will prompt you for the password and only open the project if the correct password is entered.

When you password protect a project, Forecast Pro TRAC uses Microsoft Access’s security functionality to password protect the project’s .mdb and .TRAC files. This means that in addition to requiring the password to open the project in Forecast Pro TRAC, the password is also required to open the project’s .mdb or .TRAC file in Microsoft Access.

Project>Team archive

The team archive menu is used to create team archives, link component projects to a team archive and to open the consolidated project.

Project>Team Archive>Send to is used to create a new team archive. This option converts the current project from a stand-alone project into a component project and allows you to name the team archive file. It is important to note that the settings for forecast horizon, confidence limits percentiles, number of override rows and override adjustment mode established for this initial component project will be used for all subsequent component projects that link to the team archive.

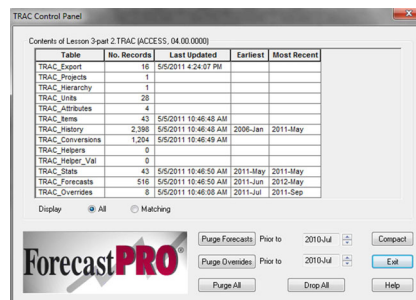
Project>Team Archive>Link to is used to link a new project to an existing team archive.

Project>Team Archive>Open is used to open a team archive directly. This will consolidate all of the component projects and allow you to view and manipulate the consolidated forecasts.

Project>Control Panel

Project>Control Panel invokes TRAC Control Panel dialog box which is used to view information about the current project's database and to purge unwanted (e.g., obsolete) forecasts and overrides.

Important: To reduce the size of the Forecast Pro TRAC database file, you must use the Compact button after purging forecasts and overrides. Purging without compacting results in the records being deleted from the database but does not change the file size.



The grid displays the contents of the database.

The Purge Forecasts button will delete all forecasts prior to the specified date.

The Purge Overrides button will delete all overrides prior to the specified date.

The Purge All button will delete all forecasts and overrides that are currently in the database.

The Drop All button will delete all the tables in the database and all information therein.

The Compact button consolidates the Forecast Pro TRAC database file. Use this button to reduce the size of the database file after purging forecasts and/or overrides.

The View Menu

The View menu allows you to view reports, display graphs and customize your display.

View>(All available views)

The first nine options on the View menu will toggle the selected view window on and off. This can also be accomplished using the appropriate green or yellow icon.

View>Toolbar

View>Toolbar displays and hides the Toolbar, which includes buttons for some of the most common commands in Forecast Pro TRAC. A check mark appears next to the menu item when the Toolbar is displayed.

View>Status Bar

View>Status Bar displays and hides the Status Bar, which describes the progress of the currently running forecast job, or the action to be executed by

the selected menu item or depressed toolbar button. A check mark appears next to the menu item when the Status Bar is displayed.

View>Modifiers

View>Modifiers displays and hides the currently selected forecast modifiers on the Navigator.

View>Apply Filters

View>Apply Filters toggles on or off the report filters. This can also be accomplished using the blue Filter icon.

The Window Menu

The Window menu enables you to arrange your open windows in various ways.

Window>Cascade

Window>Cascade arranges all nonminimized windows in an overlapped fashion.

Window>Tile

Window>Tile arranges all nonminimized windows in a tiled (nonoverlapped) fashion.

The Help Menu

Forecast Pro TRAC includes extensive on-line help.

Help>Help Topics

Help>Help Topics displays an index of all of the help topics available. Clicking on an entry will jump to the selected topic.

Help>User Guide (PDF)

Help>User Guide (PDF) accesses a pdf version of the Forecast Pro TRAC User's Guide.

Help>User Guide (PDF)

Help>Statistical Reference (PDF) accesses a pdf version of the *Forecast Pro Statistical Reference Manual*.

Help>Check for Updates

Help>Check for Updates will check online to see if you are running the latest release of the program. If a product update is available you'll receive a message alerting you to this fact with instructions describing how to receive the update. If your support and maintenance contract is up to date, product updates are free.

Help>About Forecast Pro TRAC

Help>About Forecast Pro TRAC displays the Forecast Pro TRAC version number and copyright notice.

Working with Team Archives

Team archives allow you to break large forecasting projects into smaller pieces that can be worked on separately and then reassembled into consolidated forecasts.

For example, suppose three demand planners are responsible for forecasting three different geographic territories, they would like to work on their territory forecasts separately and after they are complete, view and manipulate a consolidated forecast—team archives allow you to do this.

The procedure is as follows:

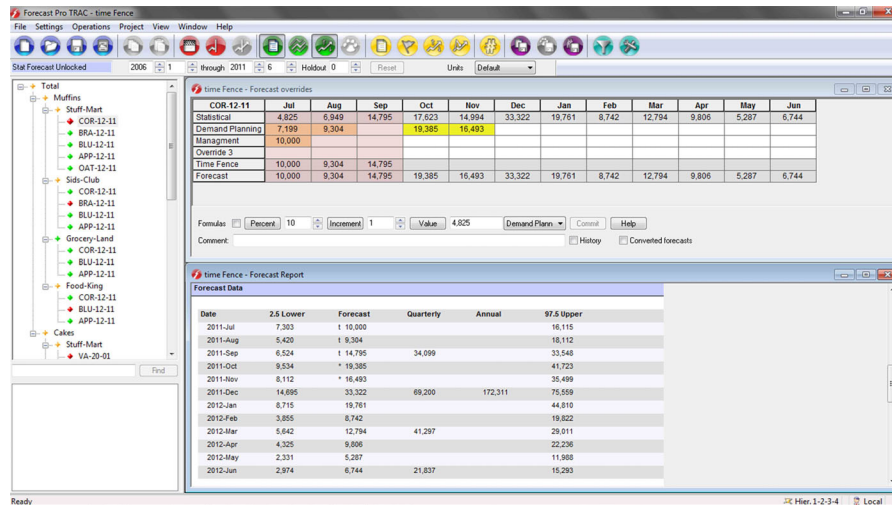
1. Create the initial component project for the first territory and use **Project>Team Archive>Send to** to convert the stand-alone project to a

linked project and to name the team archive database file. It is important to note that the settings for forecast horizon, confidence limits percentiles, number of override rows and override adjustment mode established for the initial component project for will be used for the other component projects.

2. Open a new project and use **Project>Team Archive>Link to** to specify that this project will be a component project and to link to team archive database established in step 1.
3. Repeat step 2 for any additional component projects.
4. Finalize the forecasts for the component projects and save the component projects.
5. Use **Project>Team Archive>Open** to open the consolidated project.

Using a Time Fence

Time fences are used to “lock” forecast values for a specific number of periods so that they can’t be changed via user overrides or by the generation of new statistical forecasts as new data become available. Time fences can be useful in environments where after forecasts have been finalized and acted upon (i.e., production has been scheduled, orders have been placed, etc.) there is a window of time where making changes is not feasible.



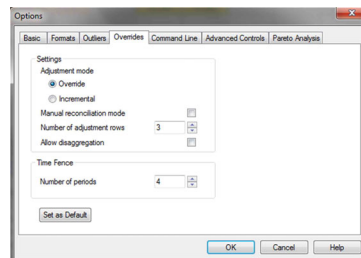
The screen above shows the Forecast overrides view for an item with a 3-month time fence. Notice the second to last row of the grid is labeled Time Fence. The values displayed in this row are the unchangeable fenced values and the same values appear in the final Forecast row.

Notice that the statistical forecast for September (14,795) does not equal the time fence value (16,457). This is because September's time fenced value was established when last month's forecasts were generated.

Let's now consider what happens next month. We update our data with July's sales, open last month's project and generate new statistical forecasts. Our 3-month time fence will now cover August through October. August and Septembers time fenced values will be retained from last month's time fenced values and October's time fenced value will equal last month's final forecast for October.

Time Fence Settings and Options

Turning on the time fence: When you first create a project, the time fence will be turned off. You turn the time fence on by selecting **Operations>Time Fence>Enable**. Once you turn a project's time fence on, *it cannot be turned off!*



Setting the length of the time fence: The default length for the time fence can be specified on the Override tab of the Options dialog box (shown above).

You can override the global setting on an item-by-item basis using the custom modifier `\TIMEFENCE=n` where n is the number of periods you wish to use. Be aware that if you use the `\TIMEFENCE` modifier to create a time fence shorter than the global time fence, it will shorten the time fence for all associated parent groups of the item.

Freezing the next period: Selecting **Operations>Time Fence>Freeze Next Period** will increase the length of all time fences in the current project by one period for the current forecast origin. If you subsequently, update your data with the next observation and create a new forecast (thus changing the forecast origin) the time fence lengths will revert back to their pre-Freeze-Next-Period settings. This option provides a way of insuring that after the forecasts are finalized someone doesn't inadvertently alter the frozen periods' forecasts prior to the data being updated, new forecasts being generated and the frozen periods' forecast becoming an officially fenced value.

Command-line Operation

You can run Forecast Pro TRAC noninteractively. When the command line to execute the program includes a project filename (*.FPProj) and the /b parameter, Forecast Pro TRAC will read in the data, create the forecasts, save all output files and then exit. This feature is particularly useful when you are integrating forecasting with other software systems and need a "hands-off" approach.

To drive Forecast Pro TRAC entirely automatically, follow these two steps.

1.) Prepare a valid project and place it in your project directory. The easiest way to prepare this file is to use Forecast Pro TRAC interactively to define all desired project settings, output formats, a script and (optionally) forecast modifiers and overrides, and then save the project using **File>Save**.

Alternatively, you can generate the file externally but this will require understanding the project file and the (optional) corresponding MDB file formats.

2.) Drive Forecast Pro TRAC by issuing the command

```
"C:\Program Files\Forecast Pro TRAC v2\ForecastProTRAC.exe" Test.FPProj /b
```

where we assume that the program is located in the directory "C:\Program Files\Forecast Pro TRAC v2" and a project named Test.FPProj is located in your current project directory. The "/b" parameter is used to indicate that you wish to run in command-line (batch) mode.

You can issue the command in any number of ways, including:

Select Run from the Start menu and issue the command from there.

Set up a shortcut to issue the command.

Issue the command from within a different application using a system call.

The Command Line tab of the **Settings>Options** dialog box allows you to specify several key command line forecasting options and the output files to save in command-line mode. This tab's functionality was fully described in the *Menu Items and Dialog Boxes* section earlier in this chapter.

Important Notes

1. If there are spaces in the pathname you must include quotation marks as illustrated in the example above.
2. If you do not want the Forecast Pro TRAC menu to appear, run the program minimized.

Chapter 6

Understanding How Forecast Overrides are Allocated

The override facility in Forecast Pro TRAC allows you to adjust the statistically generated forecasts. Changes made at any level of the forecasting hierarchy will automatically reconcile all levels. This chapter was written to clarify exactly how the reconciliation is performed and document cases where adjustments cannot be fully implemented due to conflicting overrides or program settings.

Adjustments Made to a Single Level

In this section we will describe how Forecast Pro TRAC reconciles the forecast hierarchy when overrides are made to a single level of the hierarchy.

Important: *If you restrict your overrides to a single level of the hierarchy, the reconciliation process is simple and intuitive. We strongly urge you to limit your overrides to a single level if at all possible.*

Figure 1 below depicts a simple forecast hierarchy prior to any overrides being entered. Notice that at this point the Statistical forecasts equal the committed Forecasts.

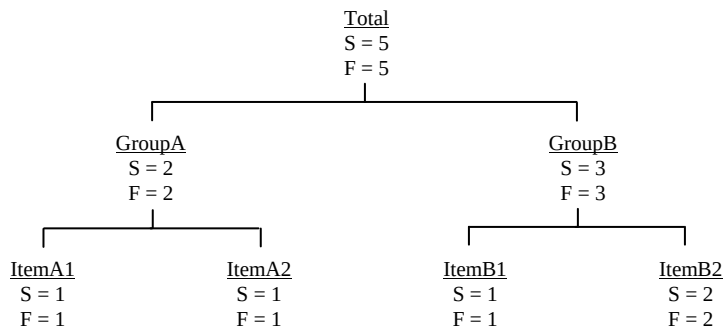


Figure 1.

Let's now modify the above hierarchy by overriding the forecast for ItemA1 to equal 75. This results in the hierarchy shown in Figure 2 below.

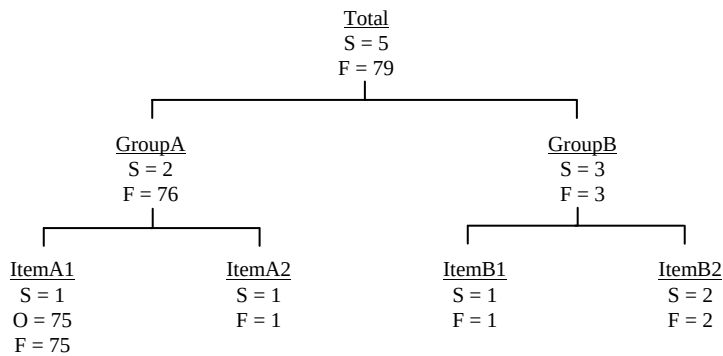


Figure 2.

Notice that at this point the committed Forecasts for GroupA and Total do not equal the Statistical forecasts.

If we had started with the hierarchy depicted in Figure 1 and adjusted the GroupB forecast to 75 (rather than ItemA1) we would generate Figure 3.

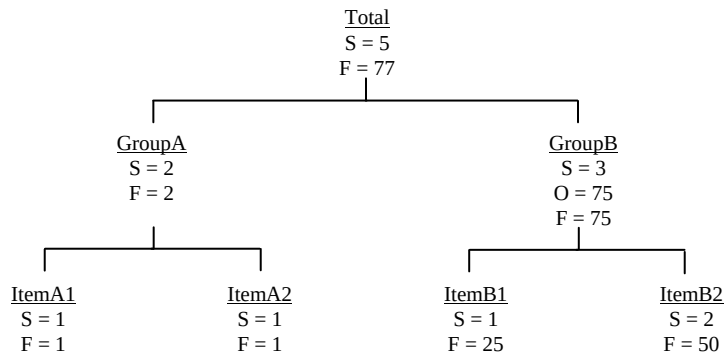


Figure 3.

Notice that the committed Forecasts for ItemB1, ItemB2 and Total do not equal the Statistical forecasts. Notice also that Forecast Pro TRAC allocated the GroupB override to ItemB1 and ItemB2 based on the proportions established by their Statistical forecasts.

Adjustments Made to More Than One Level

In this section we will describe how Forecast Pro TRAC reconciles the forecast hierarchy when overrides are made to more than one level of the hierarchy.

Important: *There are many ways that this type of reconciliation could be performed—each one leading to different forecasts. If you plan to make overrides at more than one level of the hierarchy, it is essential that you understand how Forecast Pro TRAC performs the reconciliation.*

Figure 4 below depicts a forecast hierarchy where ItemA1 has been overridden to equal 75. (It is identical to Figure 2.)

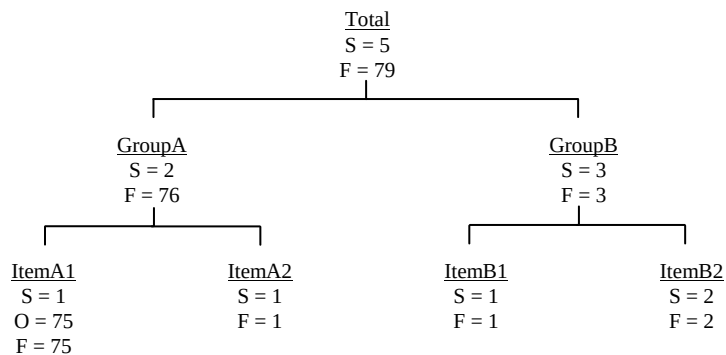


Figure 4.

Let's now modify the above hierarchy by overriding the forecast for Total to equal 500. This results in the hierarchy shown in Figure 5 below.

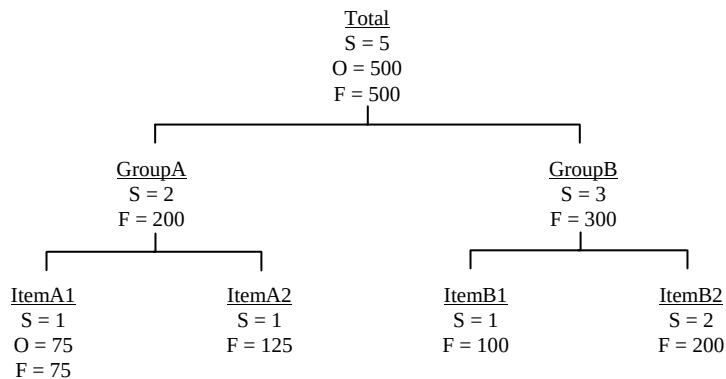


Figure 5.

Notice that:

- 1.) Forecast Pro TRAC used the *Statistical* forecasts for GroupA and GroupB to determine the allocation proportions NOT the previously committed *Forecasts* displayed in Figure 4. Using the committed Forecasts from Figure 4 would have resulted in a dramatically different allocation.
- 2.) Forecast Pro TRAC did not alter the committed Forecast value for ItemA1 because it had been explicitly overridden. When Forecast Pro TRAC

encounters an explicit override, it considers the value “locked” and will not alter it. This means that any needed allocations at a level containing “locked” forecasts will be made to the “unlocked” items only.

Let’s now modify the above hierarchy by overriding the forecast for Item A2 to equal 75. This results in the hierarchy shown in Figure 6 below.

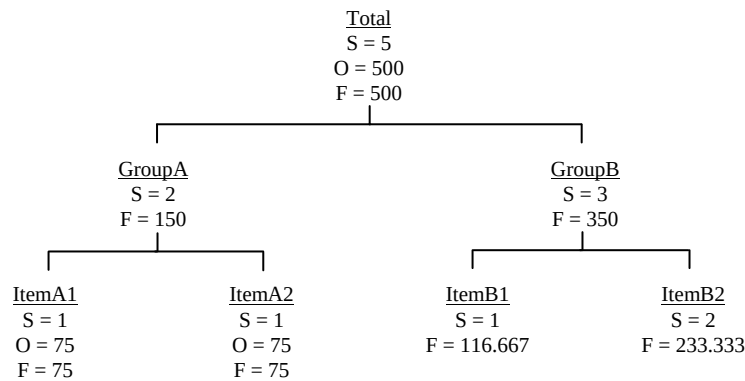


Figure 6.

Notice that normally the allocation of the 500 between GroupA and Group B would be based on the statistical forecast and result in forecasts of 200 and 300 respectively. However, we cannot change the GroupA forecast to 200 because it is “locked” at 150 due to the overrides on ItemA1 and ItemA2. Therefore, the forecast for GroupB becomes 350.

Examples Where Overrides Cannot be Allocated

If you make forecast overrides to more than one level of the hierarchy you can generate situations where the overrides cannot be allocated. In these instances an error message will be displayed and the override will not be applied.

Figure 7 below depicts a forecast hierarchy where ItemA1 and ItemA2 have both been overridden to equal 75 and ItemB1 has been overridden to equal 150.

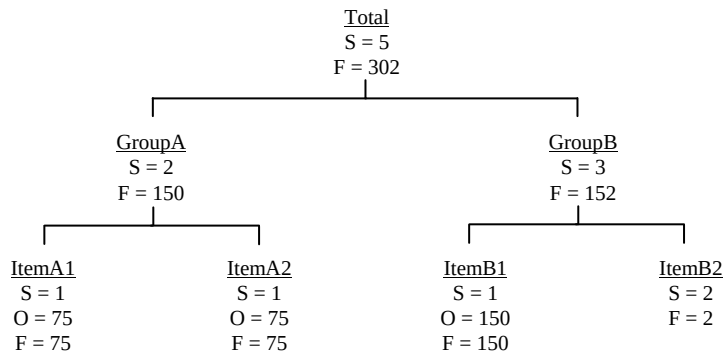


Figure 7.

Suppose you try to override the forecast for GroupA to equal 100. The override could not be applied because both ItemA1 and ItemA2 are “locked”. Forecast Pro TRAC will display an error message and reject the override.

Let’s now modify the above hierarchy by overriding the forecast for GroupB to equal 50. This results in the hierarchy shown in Figure 8 below.

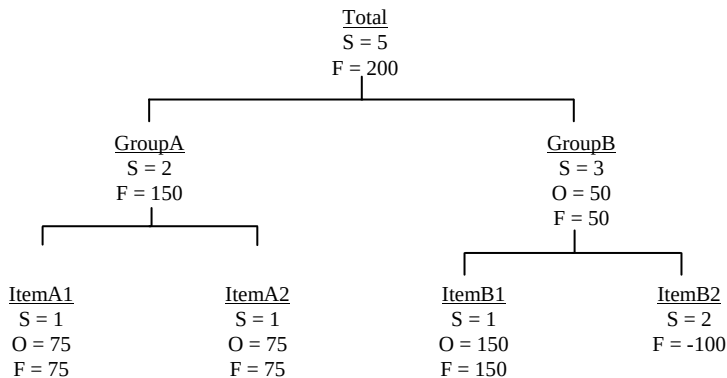


Figure 8.

Notice that the override for GroupB resulted in a negative committed Forecast for ItemB2. This result assumes that the “Allow Negative Forecasts” setting in the Forecast Pro TRAC Options dialog box was selected. If this setting was not selected, the override could not be made and Forecast Pro TRAC would display an error message and reject the override.

Summation

It should be quite apparent that if you make adjustments to more than one level of a hierarchy the reconciliation becomes quite complex. Although several of the examples presented seemed involved, they were actually quite simple hierarchies consisting of only 3 levels and 4 end-items. Most users of Forecast Pro TRAC are working with thousands of items and much more complex hierarchies.

In developing the reconciliation routine for Forecast Pro TRAC the authors considered using several different algorithms. In many situations the choice of which algorithm to use would change the forecast values—sometimes significantly. None of the algorithms were “statistically superior” to the others—they were simply different.

Virtually all of the complexity (and differences between algorithms) disappears if you restrict yourself to making forecast adjustments to a single level of the hierarchy. Although we’ve stated this previously, it’s worth repeating:

If you restrict your overrides to a single level of the hierarchy, the reconciliation process is simple and intuitive. We strongly urge you to limit your overrides to a single level if at all possible.

Appendixes

Speeding Up the Program

If decreasing processing time is important for your application, you may wish to investigate some of the following options.

1. Use the 64-bit Version

Forecast Pro TRAC can be installed as either a 32-bit or 64-bit application. If you are currently running the 32-bit version, migrating to the 64-bit version will speed up various operations such as opening and saving projects and will also allow you to work with larger data sets.

2. Work Locally

Working with projects stored on a network drive can be substantially slower than working on a project stored locally. Reading input data over the network and saving output files to network drives can also be substantially slower than reading and writing from a local drive.

If you are currently saving your projects to a network drive, saving them to a local drive will improve performance considerably. If you are currently

reading your input data from a network drive and/or saving output files to a network drive, moving them to a local drive will speed up read/write operations considerably.

3. Use Zipped Projects

As we mentioned above, in some networked environments, working with projects stored on a network drive can be substantially slower than working on a project stored locally. To improve performance in these cases, Forecast Pro TRAC supports “zipped” projects. When you save a zipped project, Forecast Pro TRAC zips the four standard project files described in a previous section of this manual into a single file with the extension .FPZip.

When you open a zipped project, Forecast Pro TRAC copies the zipped file from the network drive to a local workspace, unzips the project files and opens the project—allowing you to work on your project locally, even though it was saved to a network drive. When you resave your zipped project, Forecast Pro TRAC will zip the updated local project files and save the updated .FPZip file to the network drive.

To save and open zipped projects, you select FPZip as the file type in the **File>Save as** and **File>Open** dialog boxes.

4. Upgrade Your Hardware

Upgrading your hardware will improve performance dramatically. Forecast Pro TRAC will run on any Intel processor from the 386 on. Since this product deals with large amounts of floating point data, it makes sense to run it on as fast a machine as possible.

As an illustration, using expert selection and four years of monthly history per item, a Core2/2.2GHz machine forecasted 10,000 items in 39 seconds. The same run took 4 minutes on a Pentium III/600MHz machine and 24 minutes on a Pentium/90MHz.

Having enough RAM is also important—we recommend 2 Gigs if you are running a 32-bit operating system and as much RAM as your budget can afford if you are running a 64-bit operating system.

As you use the program, Forecast Pro TRAC is storing and retrieving a great deal of information in memory. If you do not have an adequate amount of RAM Forecast Pro TRAC will resort to using virtual memory (i.e., caching to your hard drive). This is substantially slower than using RAM. Increasing the amount of RAM in your computer will improve performance of all of your applications.

5. Use the Manual Override Mode

If you make overrides to large complex hierarchies, the reconciliation can take a little time. To minimize the reconciliation time, Forecast Pro TRAC supports a manual override mode. When this mode is active, the override window will include a Retain button as well as a Commit Button. The Retain button is used to accept overrides without reconciling the hierarchy. In this mode you would typically enter and retain all of the overrides you wish to make (i.e., for multiple items) and then click Commit to perform the reconciliation. The control to turn on manual override mode is found on the Overrides tab of the **Settings>Options** dialog box.

6. Use the Manual Archive Mode

By default, Forecast Pro TRAC will automatically save all changes to the TRAC database every time you save your forecast project. For large hierarchies this can be time consuming. Forecast Pro TRAC allows you turn off the automatic archiving feature using an option of the Advanced Controls tab of the **Settings>Options** menu. If you turn this option off, saving your projects will be much *quicker*, however, if you want to archive your forecasts for tracking purposes, you will need to do so explicitly using **Operations>Archive forecasts** or the blue Archive Forecasts icon (.

7. Use Manual Recalculation

By default, Forecast Pro TRAC will automatically recalculate the forecasts and re-reconcile the hierarchy every time you apply a forecast modifier. For large hierarchies this can be time consuming. Forecast Pro TRAC allows you turn off the automatic recalculation using an option of the Advanced Controls tab of the **Settings>Options** menu. If you turn this option off, when you specify a forecast modifier the forecasts will not be updated until you click the red Forecast icon (). This allows you to specify multiple forecast modifiers

without having to wait for the program to recalculate the forecasts in between each specification.

8. Optimize Outlier Detection and Correction for Speed

The outlier detection and correction algorithm will slow down the processing. If you wish to use outlier detection and correction but speed is of concern, one option is to initially run the forecasts in the detection only mode to detect the outliers and then turn outlier detection off and use the \OUTLIER=CORRECT modifier to perform the corrections on the detected items.

9. Don't Use .xlsx Files

If you are using xlsx files you might consider switching to csv or xls files. Xlsx files are slower to read than csv and xls files and use over twice as much memory. Also, if you are using large spreadsheet files breaking them up into several smaller files or increasing the amount of RAM available will speed up processing.

10. Optimize Model Selection for Speed

Specifying “Exclude ARIMA” on the Advanced Controls tab of the **Settings>Options** dialog box will speed up forecast generation considerably. This option will remove Box-Jenkins models from consideration when using expert selection.

If you are forecasting data where the number of periods per cycle is greater than 13 (e.g., weekly data) you might consider turning on the “Exclude seasonal simplification” option in the Advanced Controls tab of the **Settings>Options** dialog box. If this switch is on, Forecast Pro TRAC's expert selection mode will not consider seasonally simplified forms of exponential smoothing models. This will speed up forecast generation considerably.

Specifying the models to use rather than using the expert selection will substantially improve performance. This will require some work to determine the best type of model to use for your data. The best way to determine the appropriate model for your data set is to experiment using the forecast

evaluation procedures (see methodology chapter in the *Forecast Pro Statistical Reference Manual* for details).

End-User License Agreement

This End-User License Agreement (“EULA”) is a legal agreement between Licensee (either an individual or a single entity) and Business Forecast Systems, Inc. (“BFS”) for the BFS software that accompanies this EULA.

1. DEFINITIONS

A. “BFS” means Business Forecast Systems, Inc., 68 Leonard Street, Belmont, MA 02478 USA, the author and owner of the copyright of this computer program product.

B. “Computer” means the single computer, workstation, terminal or other digital electronic device on which You use this program.

C. “Software” means the set of computer software programs in this package, regardless of the form in which You subsequently use it.

D. “Licensee” means an individual or single entity exercising rights under and complying with all the terms of this EULA. In the remainder of this EULA, the Licensee is referred to as “You.”

E. “Authorized User” means the Licensee in the case where the Licensee is an individual. In the case where the Licensee is an entity, “Authorized User” means (i) an employee of the Licensee, but only while such employee is acting within the scope of such employee’s employment by Licensee; and (ii) the primary user of the Computer on which the Software is installed.

If You do not agree with the terms of this EULA, BFS does not grant any license to the Software and You should not download, install or use the Software. In such event that You do not agree with the terms of this EULA and have already installed or downloaded the Software, You must remove the Software from your Computer and return to BFS the complete software package, including disks and printed materials, and destroy all copies (or, if You downloaded the Software, notify BFS in writing that You have removed the Software from your Computer and destroyed all copies). If You do not

comply with these return and notification requirements within thirty days (30) of your receipt of the Software, You will not be entitled to a refund of any license fees You paid.

2. OWNERSHIP

BFS retains title, ownership, and all rights and interests in and to the Software, documentation and all other materials supplied by BFS. BFS does not sell the Software or any copies thereof, but only grants limited licenses to use the Software in accordance with the terms of this EULA.

3. GRANT OF LICENSE

Upon acceptance of this EULA, BFS grants You a non-transferable, non-exclusive, limited right to use this copy of the Software. You may use the Software and the associated documentation only in connection with one Computer. You may physically move the Software from one Computer to another, provided that the Software is used on only one Computer at a time. You may not move the Software electronically from one Computer to another over a network. This license is granted for use by an individual Authorized User, and, in no event shall there be more than one Authorized User on the Computer where the Software is installed; e.g., there shall be no common sharing of a “Forecast Pro computer.” Each Authorized User must have a separate license to use the Software on his or her Computer.

4. LICENSE RESTRICTIONS

You acknowledge that the Software and its structure, organization, and source code constitute valuable trade secrets of BFS. You shall not, nor shall permit, assist or encourage any third party to:

- copy, modify, adapt, alter, translate, reverse engineer, decompile, disassemble, or attempt to derive the source code for the Software.
- merge the Software with other software and/or create derivative works from the Software.
- sublicense, distribute, publish, sell, lease, rent, loan, or otherwise transfer or allow access to the Software to any third party.

- use the Software in the operation of a service bureau.
- defeat, disable or circumvent any security measures BFS may use to prevent unauthorized use or copying of the Software.

5. TRANSFER OR REPRODUCTION

You may not transfer or reproduce the Software with the exception of making a maximum of two (2) copies of the Software to be used for backup purposes only. When using a Computer with a hard disk, one copy of the Software may be installed on the hard disk provided that the copy is removed if the Software is used on another Computer.

6. LIMITED WARRANTY

THE SOFTWARE, THE DOCUMENTATION, AND ANY OTHER MATERIALS THAT MAY BY BE PROVIDED BY BFS ARE PROVIDED "AS IS" WITHOUT ANY WARRANTY OF ANY KIND. BFS HEREBY EXPRESSLY DISCLAIMS ALL WARRANTIES WITH REGARD TO THE SOFTWARE, THE DOCUMENTATION, AND ANY OTHER MATERIALS, WHETHER EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING OUT OF COURSE OF DEALING OR COURSE OF PERFORMANCE. BFS EXPLICITLY DOES NOT WARRANT THAT THE SOFTWARE WILL MEET ALL OF YOUR REQUIREMENTS OR THAT THE OPERATION OF THE SOFTWARE WILL BE ERROR-FREE. YOU ACKNOWLEDGE THAT YOU HAVE RELIED ON NO WARRANTIES AND NO WARRANTIES ARE MADE HEREIN BY BFS.

7. LIMITATION OF LIABILITY

BFS SHALL NOT BE LIABLE FOR ANY LOSS OR DAMAGE THAT MAY BE RELATED TO THE FURNISHING, PERFORMANCE, OR USE OF THE SOFTWARE, INCLUDING WITHOUT LIMITATION ANY INDIRECT, SPECIAL, INCIDENTAL, ECONOMIC, LOST PROFIT, OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND WHATSOEVER EVEN IF BFS HAS BEEN ADVISED OF THE POSSIBILITY OF THOSE DAMAGES. IN NO EVENT SHALL BFS'S LIABILITY UNDER THIS

EULA EXCEED THE AMOUNT PAID FOR THE SOFTWARE LICENSE, IF ANY.

8. TERM AND TERMINATION

This EULA is effective until terminated. Your rights under this EULA will terminate automatically without notice from BFS if You fail to comply with any provision of this EULA. Upon termination of this EULA, You must destroy all copies, full or partial, of the Software. You agree that upon termination of this EULA for any reason, BFS may take actions so that Software no longer operates.

9. GENERAL TERMS AND CONDITIONS

A. You acknowledge that You have read this EULA understand it, and agree to be bound by its terms and conditions. This EULA supersedes all prior agreements, oral or written communications, proposals, representations and warranties and prevails over any conflicting or additional terms of any quote, order, acknowledgment, or other communication between the parties relating to its subject matter during the term of this EULA. No modification of this EULA will be binding, unless made in writing and signed by an authorized representative of each party.

B. In the event that any portion of this EULA is held unenforceable, the unenforceable portion shall be construed in accordance with applicable law as nearly as possible to reflect the original intentions of the parties, and the remainder of this EULA shall remain in full force and effect.

C. This EULA will be governed by and construed and enforced according to the laws of the Commonwealth of Massachusetts, USA excluding its conflict of law provisions.

Suggested Reading

The *Forecast Pro Statistical Reference Manual* is a pdf document that is copied to the program directory when you install Forecast Pro. It is also accessible via the Forecast Pro help system and is the primary suggested reference for all of the forecasting techniques, statistics and algorithms found in Forecast Pro.

The *Forecast Pro Statistical Reference Manual* includes an extensive bibliography. A few recommended textbooks include:

J. S. Armstrong [2001] *Principles of Forecasting: A Handbook for Researchers and Practitioners*, Norwell MA: Kluwer Academic Publishers.

K. Kahn [2006] *New Product Forecasting: An Applied Approach*, Armonk NY: M.E. Sharpe.

S. Makridakis, S. C. Wheelwright and R.J. Hyndman [1998] *Forecasting Methods and Applications*, Third Edition, New York: Wiley.

P. Newbold and T. Bos [1990] *Introductory Business Forecasting*, Cincinnati: South-Western.

Index

\ANALOG, 180	\POW, 184
\ARIMA, 177	\SALY, 178
\BASS, 180	\SALYDI, 179
\BJ, 177	\SALYDP, 179
\CFIT, 179	\SALYI=, 178
\CFIT=, 179	\SALYP=, 178
EXPO, 179	\SIMPLE, 176
GROW, 179	\SMA=, 178
LINE, 179	\TOPDOWN, 103, 105, 170, 171, 172, 183
QUAD, 179	\WINTERS, 176
\CONST, 177	\XY, 177, 181
\DISCRETE, 177	_GROUP, 169
\EVENT, 93, 181, 182	1-2-3, 139, 140
\EXSM, 176	Adjustment mode, 222
\EXSM=, 176, 181	Allow disaggregation, 222
\FIXED=, 179	Allow negative forecasts, 218
\FIXEDAFT=, 179	Allow no history, 220
\HOLT, 176	Archive forecasts, 229
\INDEXES, 104, 170, 172, 183	Archive forecasts automatically, 227
\INTER, 178	Automatic recalculation, 226
\OUTLIER=, 182	

- Bass Diffusion
 - modifiers, 180
- Bass Diffusion model, 15, 114
- Bottom-up, 102
- Box-Jenkins, 14
 - modifiers, 177
- By Analogy, 111
 - modifiers, 180
- Cannibalization, 100, 106
- Cascade, 234
- Check for updates, 235
- Close, 216
- CMAPE, 202
- Code page, 220
- Column delimiter, 219
- Comma delimited files, 219
- Command line dialog box, 223
- Command-line operation, 81, 238
- Compatible series, 231
- Component Analysis display, 202
- Component weights, 201
- Confidence limits, 12, 184, 218
- Control Panel, 232
- Convert to SQLite, 229
- Croston's model, 13
- CSV, 139, 140
- Curve fitting
 - modifiers, 179
- Data directory, 217
- Data files
 - CSV, 139, 140
 - format, 218
 - header information, 138
 - MLT, 140, 145
 - path, 217
 - selecting format, 139
 - WK*, 139, 140
 - XLS, 139, 140
- Data length, 15, 136
- Data mode, 218
 - .WK1
 - column format, 143
 - row format, 141
 - .XLS
 - column format, 143
 - row format, 141
- Data only, 196
- db files, 161
- Decimal separator, 219
- Default hierarchy only, 214
- Default units only, 213
- Detection and correction, 221
- Detection only, 221
- End-item Analysis display, 202
- Event adjustment, 105
- Event models, 14, 91, 180
- Event variable, 91, 93, 94
- Excel, 139, 140
- Exception reports, 166, 204
- Exclude ARIMA, 226
- Exclude seasonal simplification, 226
- Exit, 216
- Exponential smoothing, 14
 - modifiers, 176
- Fcb files, 162
- File Close, 216
- File Exit, 216
- File New, 216
- File Open, 216
- File Print, 216
- File Print Preview, 216
- File Print Setup, 216
- File Save, 216
- File Save as, 216
- Forecast by Analogy, 14
- Forecast command, 228
- Forecast file prefix, 213
- Forecast horizon, 218

- Forecast modifiers, 175
- Forecast projects, 160
- Forecast Report view, 193
- Forecast reports, 163
- FPProj files, 161
- FPZIP files, 162, 250
- Generic dates, 226
- Graph settings, 195
- Graph view, 195
- Hardware requirements, 7
- Header, 138
- Help topics, 234
- Hierarchy menu, 191
- Hot List, 192
- Icons, 187
- Import Archived Overrides, 230
- Import Modifiers, 230
- Import Overrides, 230
- Include group totals, 220
- Include iteration statistics, 221
- Incremental adjustments, 222
- Inherited Overrides row, 199
- Initialize Archive, 228
- Installation
 - 32-bit, 10
 - 64-bit, 10
 - automatic, 9
- Item Report, 165
- Item Report view, 204
- Leading zeros, 219
- License agreement, 253
- Main window, 20
- Manual reconciliation mode, 222
- Maximum iterations, 221
- M-Competitions, 127
- Mdb files, 162
- Missing values, 137, 219
- MLT, 140, 145
- Modifiers, 183, 234
- Multiple-level forecasting, 168
- Navigator, 190
- Negative forecasts, 218
- New, 216
- Numeric Output Design, 213
- Numeric Output files, 163
- Numeric Output view, 212
- Numeric Precision, 220
- ODBC, 140, 147
- ODBC Connect, 227
- Open, 216
- Operations Forecast, 228
- Operations ODBC Connect, 227
- Operations Read Data, 228
- Operations Script, 228
- Options dialog box, 217
- Outlier detection/correction, 182, 221
- Outlier Report, 166
- Outlier Report view, 212
- Outliers, 99
- Output directory, 218
- Override Report view, 211
- Override reports, 165
- Override view, 198
- Passwords, 231
- Percentage precision, 220
- Periods per cycle, 139
- Periods per year, 139
- Point forecast, 12
- Power transformation, 184
- Print Preview, 216
- Print Setup, 216
- Printing, 216
- Promotions, 92, 100
- Read Data, 228
- Safety stock lead time, 218
- Save, 216
- Save as, 216
- Script, 167, 228

- defining, 167
- multiple-level, 168
- overview, 21
- Seasonal indexes, 97
- Sensitivity outlier setting, 221
- Series Analysis display, 202
- Settings Options, 217
- Short lived products, 106
- Simple moving average, 13
- Speeding up the program, 249
- Spreadsheet data, 139, 140
- SQLite, 227
- Starting Forecast Pro TRAC, 19
- Starting period, 138
- Starting year, 138
- Statistical row, 198
- Status bar, 233
- System requirements, 7
- Team Archive
 - Link to, 232
 - Open, 232
 - Overview, 235
 - Send to, 232
- Text file encoding, 220
- Thousands separator, 219
- Tile, 234
- Time Fence
 - default length, 222
 - Enable, 229
 - Freeze Next Period, 229
 - overview, 236
- Toolbar, 187, 233
- Top-down, 103
- TRAC files, 161
- Tracking report, 164, 200
- Trailing zeros, 219
- Updates, 235
- Use SQLite, 227
- Variable
 - description, 138
 - header information, 138
 - name, 138
- Very simple models, 178
- View Apply Filters, 234
- View Modifiers, 234
- View Status bar, 233
- View Toolbar, 233
- Weekly data, 95
- Weighting transformation, 181
- Window Cascade, 234
- Window Tile, 234
- Winters, 97
- WK*, 139, 140
- WMAPE, 202, 203
- XLS, 139, 140
- Zeros, 137
- Zipped projects, 162, 250